# THE IRON TRADE REVIEW

VOLUME XXXVI CLEVELAND, OHIO, DECEMBER 31, 1903 NUMBER 53

## THE WEEK IN IRON CIRCLES.

### THE MARKET AT LARGE.

With growing activity in some directions, even at the expense of prices, the closing week of the year finds increasing expectations in the iron and steel market. To be sure, the wage reductions, of which fresh announcements are made this week, give a decided appearance of striking sail and preparing to run close to the wind; but the depressing effect of these reductions has been discounted, and they are now even looked upon in some quarters as arguing improvement, because, along with the sharp cuts in coke prices, they put manufacturers where they can consider doing business again. The lower prices of the week are in finished material chiefly. In pig iron the tendency for the time being is toward firmness in Southern iron while Northern furnaces have shaded prices in some instances to take business in closely competitive territory. Several conferences have been held at Birmingham this week looking to the reorganization of the Southern pig iron association or the adoption of some plan to establish prices on a firmer basis and keep them there. Reference was made to this movement in these columns last week and there seemed then little chance of any outcome. Nothing definite has come from this week's meetings, but the problem is still being worked upon. The proposal is to make $10 at furnace the minimum for No. 2 foundry and by some producers $10 for No. 3 is talked of. In the conferences of this week the same interests included in the last agreement have been represented in addition to the Sheffield, Ala., furnaces and another company not heretofore interested. The business of the week has been done almost entirely at $9.50 Birmingham for No. 2. Northern furnaces are quoting prices based on their revised costs, and are getting business again, partly because a number of Southern furnaces are fairly sold up for the first quarter.

There are some better indications in finished material though no real buying movement is looked for until after the opening of the year. A number of railroads are buying equipment, and orders aggregating 2,500 cars have been placed by the New York Central, the Chicago & Northwestern and the Illinois Central. In steel cars pending business aggregates 7,000 cars, and an order from the Wabash Railroad is for 1,000 cars. Chicago notes more activity in plates, 5,000 tons being sold in the week. Shipyard and bridge works have work in hand for which material must be provided after Jan. 1. Railroads have plans for a considerable amount of bridge work for which orders will be placed shortly, now that the basis for plates, shapes and bars is established for the early part of the year. There have been some rumors abroad as to the dissolution of the steel pool, but they are as unfounded as is the report on the other hand that prices have been fixed for all the coming year. Wire products have been reduced about $3 a ton the past week. At Pittsburg the leading local wire interest is quoting the same prices as the American Steel & Wire Co. Lower prices are announced for merchant sizes of wrought pipe and the association of independent manufacturers meeting at Pittsburg this week decided on discounts which are substantially the same as those of the National Tube Co. Prices of sheets are about $1 a ton lower in Central Western markets and Indiana bar iron sellers have quoted low prices on their product in Northern Ohio markets.

### PITTSBURG.

OFFICE OF *The Iron Trade Review*, 429 PARK BUILDING, Dec. 30.

The market has been quiet in all lines during the week, consumers desiring to wait until next month before placing orders for extended deliveries. The new year will open up with the market in a much better condition than it has been in the past four months, a number of blast furnaces and steel works preparing to resume early in January.

Orders have been accumulating for some time, and except where deliveries were urgent manufacture has been postponed until after the first of the year, when lower wages will prevail at the blast furnaces and mills. Seven and possibly eight of the idle furnaces of the Carnegie Steel Co. will be placed in operation by the middle of January, and the operation of these furnaces means the resumption of operations at several of the idle steel plants. Of course the tonnage on the books of the steel manufacturers this year is small as compared with the immense tonnage they had booked one year ago. The rail mills carried over fully 400,000 tons of rails and had orders booked for upwards of 1,800,000 tons for delivery during the year. This tonnage was increased during January and early in February to two and a half million tons. The combined structural and plate tonnage booked amounted to about 1,500,000 tons. For delivery in 1904 the rail mills have little more than 800,000 tons booked while the plate and structural mills are not carrying a very heavy tonnage on their books.

With lower coke, lower wages, and lower limestone, the merchant furnaces in the Valleys will be better able to compete and meet the prices of the Southern producers after Jan. 1, and several idle stacks are preparing to resume. Coke production at the present time is at its lowest ebb. Fully 15,000 ovens in the upper and lower Connellsville region are idle, the H. C. Frick Coke Co. alone having about 10,000 of its 18,000 ovens in the entire Connellsville region inactive.

In finished lines the market continues exceedingly quiet. Concessions continue to be made on black sheets in large lots and on desirable sizes, while on wire nails and wire products prices have been lowered $3 to $4 per ton. Iron bars in desirable lots can be placed at 1.25c, Youngstown, but prices on steel bars are being firmly maintained. The National Tube Co. this week announced a new list of discounts.

**Pig Iron.**—There has been practically no heavy buying during the week; consumers that are buying are covering for immediate requirements only, while those figuring on

large quantities for first quarter delivery have deferred buying until after the first of the year. Now that the Northern furnaces are assured of $1.50 to $1.60 coke for the first half of next year, lower prices are being made and the Southern operators are likely to find the competition of the Northern furnaces much keener than it has been during the past three months, when stacks were idle which if operative would have been taking in $3.50 and $4 coke. On foundry No. 2 Northern furnaces are quoting $13.75 to $14, Pittsburg, and it is believed that slightly below this could be done for first half delivery. Malleable interests that have been in the market have not bought largely as yet nor have there been any heavy purchases of Bessemer iron. Malleable Bessemer is quoted at $13 at the furnace, and standard Bessemer at $13.25 to $13.50. Several hundred ton lots of forge have been sold at prices ranging from $13 to $13.25, Pittsburg. Fully three-fourths of the stacks in the Valleys as well as the Pittsburg district continue idle, but a number of the idle merchant furnaces are preparing to blow in shortly after the first of the year. We revise quotations as follows:

| | |
|---|---|
| Bessemer, Valley | $13 25 to 13 50 |
| Bessemer, Pittsburg | 14 10 to 14 35 |
| No. 1 Foundry | 14 25 to 14 50 |
| No. 2 Foundry | 13 85 to 14 25 |
| Gray Forge, Pittsburg | 13 00 to 13 25 |
| Chilled Basic, Valley | 12 90 to 13 25 |
| Chilled Basic, Pittsburg | 13 75 to 14 10 |

**Steel.**—We note the sale of 1,000 tons of Bessemer billets at the pool price of $23, Pittsburg. Some concessions have been reported on open-hearth, but it is doubtful if any will be offered on Bessemer. The report that present prices of billets will be maintained by pool action throughout 1904 scarcely needs denial. While it is true that the association decided to continue its operations for another year as the plate, structural and shafting associations decided, the statement that prices for 1904 have been fixed at $23 is without foundation. In some quarters the maintenance of this price until the next quarterly meeting is questioned, unless the demand materially increases. We make the following quotations: Bessemer and open-hearth billets, 4 x 4 inches, and slabs, up to and including 0.25 carbon, $23, Pittsburg, Wheeling, Valley, Johnstown, Ashland, Ky., Ironton, O., and Lorain, O.; 0.26 and including 0.60 carbon, $1 advance and 0.61 to 1.00 carbon, $2 advance. Billets smaller than 3⅞ inches and sheet and tin bars are $1 per ton extra. Bessemer and open-hearth rods are quoted at $30, Pittsburg.

**Ferro-Manganese.**—The market continues quiet and concessions continue to be made on fairly large lots. We quote domestic 80 percent at $46.50 to $47 in carload lots delivered east of the Mississippi river. Lower prices are made on larger lots for nearby delivery.

**Muck Bar.**—There is little buying and prime muck is quoted nominally at $25, f. o. b. mill, Pittsburg. On a large order this price could no doubt be shaded $1 per ton.

**Skelp.**—The skelp market continues quiet and sheared iron skelp is held at 1.50c to 1.55c, while grooved is held at 1.45c to 1.50c. Steel skelp, both grooved and sheared, is held at 1.45c to 1.50c.

**Rails and Track Material.**—The date for the meeting of light rail manufacturers has not yet been set, but it is probable that it will be called the second or third week in January. The rail mills of the country begin the new year with about 800,000 tons on their books as compared with 2,200,000 tons one year ago, which early in February was increased to two and a half millon tons. We make the following quotations: Standard sections, 50 pounds and over, in lots of 500 tons and over, $28; car lots and less than 500 tons, $30; less than car lots, $32; 16 and 20 pounds, $26.50 to $27; 25 to 40 pounds, $25 to $25.50. Track material: Spikes, 1.95c to 2c; track bolts, square nuts, 2.25c to 2.30c; hexagon nuts, 2.40c to 2.45c; fish plates, 1.60c on orders accompanying large rail contracts, otherwise 1.80c to 1.85c is asked.

**Plates.**—Little new business is being placed and the market continues quiet. Steel car orders now pending aggregate 7,000, the Wabash railroad this week having come into the market for the delivery of 1,000 cars next year. These orders will all be closed after the first of the year and will require fully 65,000 tons of plates. We make the following quotations: Tank plates, ¼-inch thick and up to 100 inches in width, 1.60c at mill, Pittsburg; flange and boiler steel, 1.70c; marine, ordinary firebox, A. B. M. A. specifications, 1.80c; still bottom steel, 1.80c; locomotive firebox, not less than 2.10c, and it ranges in price to 3c. Plates more than 100 inches, 5c extra 100 pounds. Plate 3-16-inch in thickness, $2 extra; gauges Nos. 7 and 8, $3 extra. These quotations are based on carload lots, with 5c extra a hundred pounds for less than carload lots. Terms, net cash, in 30 days.

**Structural Material.**—In the construction of the 7,000 steel cars for which the bids of the car manufacturers are now out, at least 35,000 tons of structural material will be required. Little new business has been placed during the week. Quotations are unchanged as follows: Beams and channels, 3 to 15 inches, 1.60c; 18 to 24 inches, 1.70c; tees, 1.65c; zees, 1.60c; angles, from 3 to 16 inches, 1.60c; universal mill plates, 1.60c.

**Bars.**—The buying of both iron and steel bars continues limited to small lots for early deliveries. Steel bar prices are being firmly maintained, while on iron bars 1.25c, Youngstown, is being freely done on desirable tonnages. We quote as follows: Bessemer steel bars, 1.30c; open-hearth, 1.40c; plow beams and cultivator beams, 1.30c, net; channels, angles, zees and tees, Bessemer, under 3 inches, 1.40c; common bar iron, 1.30c to 1.35c, Pittsburg. The following differentials are maintained on steel: Less than 2,000 pounds of a size and not less than 1,000 pounds, 10 cents advance; less than 1,000 pounds of a size, 30 cents advance. Hoops are quoted at 1.65c, full extras, in 250-ton lots and over, and 1.75c in less than 250-ton lots. Bands are quoted at 1.30c and take the bar extras.

**Sheets.**—This week the officials of the Amalgamated Association sent out notices of the acceptance of the 10 percent reduction and the increase of the limit of output 11 percent in all union sheet mills beginning with Jan. 1, as announced in our last issue. A number of the independent sheet mills, now idle, will resume early in January, as they are now in a much better position to compete. Quotations on black sheets are being shaded from $1 to $2 per ton, but this is only done where the orders are large and the sizes very desirable. Black sheets in 500-bundle lots and over are held as follows: No. 30, 2.75c; No. 29, 2.65c; No. 28, 2.35c to 2.40c; No. 27, 2.25c to 2.30c; Nos. 25 and 26, 2.20c to 2.25c; Nos. 22 and 24, 2.15c to 2.20c; Nos. 18 and 20, 2.10c to 2.15c; Nos. 14 and 16, 2.05c; Nos. 10 and 12, 1.75c to 1.80c. Galvanized, Nos. 10 to 17, 2.40c to 2.45c; Nos. 17 to 22, 2.60c to 2.65c; Nos. 22 to 25, 2.80c to 2.85c; Nos. 25 and 26, 3c to 3.05c; No. 27, 3.20c to 3.25c; No. 28, 3.40c to 3.45c; No. 29, 3.80c to 3.85c; No. 30, 4.30c.

**Pipes and Tubes.**—A revised list of discounts on merchant pipe and boiler tubes has been issued by the largest producer. Our revised list in carload lots to consumers, f. o. b., Pittsburg, plus freight to destination according to Tube Rate Book are as follows:

MERCHANT PIPE.

| | Steel. | | Iron. | |
|---|---|---|---|---|
| | Black. | Galv. | Black. | Galv. |
| ⅛, ¼ and ⅜ inch | 70 | 60 | 67 | 57 |
| ½ inch | 73 | 63 | 70 | 60 |
| ¾ to 6 inch | 77 | 67 | 74 | 64 |
| 7 to 12 inch | 71 | 61 | 68 | 58 |

EXTRA STRONG, PLAIN ENDS.

| | Steel. | | Iron. | |
|---|---|---|---|---|
| | Black. | Galv. | Black. | Galv. |
| ⅛ to 8 inch | 69 | 59 | 65 | 55 |

DOUBLE EXTRA STRONG, PLAIN ENDS.

| | Steel. | | Iron. | |
|---|---|---|---|---|
| | Black. | Galv. | Black. | Galv. |
| ⅛ to 8 inch | 61 | 51 | 57 | 47 |

BOILER TUBES.

| | Steel. | Iron. |
|---|---|---|
| 1 to 1½ inch | 42½ | 39 |
| 1¾ to 2¼ inch | 55½ | 38 |
| 2½ inch | 58 | 43 |
| 2¾ to 5 inch | 64½ | 50½ |
| 6 to 13 inch | 55½ | 38 |

**Wire and Wire Nails.**—The largest independent interest in this city and the American Steel & Wire Co. are now

quoting identical prices, the same concessions being named on all business for Western delivery. Reductions of from $4 to $5 per ton have been made from the delivered prices through the West, but it is doubtful if better than $1.85, Pittsburg, with freight added to destination can be done on nails or $1.75 on plain wire. The market generally is quiet. Wages of wire mill workers employed by the American Steel & Wire Co., as well as by independent manufacturers will be reduced after the first of the year. We quote as follows: Wire nails, carload lots, to jobbers, f. o. b. cars Pittsburg, $1.85 to $1.90; plain wire, carload lots, $1.75 to $1.80; barb wire, carload lots, $2.15 to $2.20; staples, carload lots, $2.05 to $2.10. Galvanizing, 30 cents extra. Carload lots to retailers are held at 5 cents advance in all lines, and on less than carload lots a further advance of 10 cents is charged. Steel cut nails are quoted as follows: Carload lots, $1.90, and less than carload lots, $1.95, f. o. b. Pittsburg, plus freight to point of destination. Iron cut nails are $1.90 in carload lots and $1.95 in less than carload lots. Terms, 60 days less 2 percent off in 10 days.

**Merchant Steel.**—The demand for the finer grades of steel continues quiet and little new business is being placed. The largest local shafting manufacturer has recently closed several contracts for shafting among the cotton mills in the South. We make the following quotations: Turned cold rolled and ground shafting, 52 off in carload lots and 47 percent off in less than carload lots. Tire steel, 1.70c to 1.80c; spring steel, 2.15c to 2.20c; toe calk, 2.15c to 2.20c. Tool steel is quoted 7 cents and upwards, according to the grade.

**Old Material.**—Demand for heavy melting stock is somewhat better and small lots are being sold at $11.25 to $11.50, gross tons, Pittsburg. Cast scrap is not in very heavy demand, while the market in other lines is practically dead.

**Coke.**—Quotations on foundry coke cover a wide range, those brands extremely low in sulphur being quoted at an advance of at least 25 cents per ton over those slightly under 1 percent in sulphur. For delivery over the first half Connellsville foundry is quoted at $2 to $2.25, and furnace at $1.50 to $1.65. For the week ending Saturday, Dec. 19, the production of the upper region amounted to 103,696 tons and that of the lower region 41,167. About 15,000 ovens are now idle in the entire region.

## CHICAGO.

OFFICE OF *The Iron Trade Review*
1115 MONADNOCK BLOCK, Dec. 29.

Melters of pig iron have been the most active participants in the buying of iron and steel products in the market during the week under review. Trading was stimulated by the announcement of the two leading Southern interests that their prices after Dec. 28 would be advanced to the basis of $10 Birmingham for No. 2 foundry. Many foundrymen who had not covered have negotiated for their requirements in the first quarter of the new year at $9.50, and the transactions closed involved a number of large tonnages. While some furnaces are still offering iron at this price for delivery in January, it is doubtful if anything could be bought at less than $9.75 for shipment after that month. Northern furnaces have also shared in the heavy buying of Christmas week, and with the scarcity of local grades owing to the idleness of several Western stacks, the market is fairly firm, quotations at present being on the basis of $14.50 to $14.75 for No. 2 foundry.

Another important development of the week was the cut of $3 a ton in wire nails, smooth and barbed wire, etc., made by the leading producer of these materials. It is understood that this price is being made only to favored customers and will be withdrawn as soon as these have covered, although for some time the local interests have been meeting the cuts of independent producers in all cases in which it was necessary to close the business. Discounts on boiler tubes have also been increased during the week, and we note that black sheets are selling $1 a ton below the quotations of a week ago. Galvanized sheets are in slight demand, and 80 and 2½ percent off is freely offered. Plates are active, following the announcement that after Jan. 1 full freight to point of delivery will be added to the Pittsburg price of 1.60c, and contracts for some 5,000 tons have been closed. Specifications also show improvement, and it is the intention to start up the plate mill at South Chicago again in a week. The sudden activity of railroads in the matter of purchases of new rolling stock is significant in view of the vigorous enforcement of the policy of economy that has been going on in this quarter for the last six months. Within two weeks, orders have been placed by the New York Central for 1,000 freight cars with the Western Steel Car & Foundry Co.; the Chicago & Northwestern, 1,000 cars with Haskell & Barker; and the Illinois Central 500 cars to be built in its own shops. The American Refrigerator & Transit Co., of St. Louis, is also in the market for 1,000 refrigerator cars, and it is rumored that the order for several thousand cars, of all descriptions, which the Harriman interests have had under negotiation for some time, will be placed shortly.

**Pig Iron.**—The usual holiday dullness has not been noticed this year in the local market. It would appear that more pig iron was bought in Christmas week than in any preceding week of the month, notwithstanding that there were really only four business days in it. Contracts have been closed ranging down from 3,000 tons, although a number were in the neighborhood of 1,000 tons each. Both Northern and Southern furnaces have shared in the buying movement, the bulk of the tonnage, however, going to the latter, perhaps in view of the announcement of the two leading Southern producers that after Jan. 1 their prices would be advanced to the basis of $10 Birmingham for No. 2. The Southern market is firm, and while some furnaces are accepting $9.50 for January delivery, it is doubtful if this price would be accepted for shipments after that month. Nearly all the Southern interests are well sold for the first quarter, and several have withdrawn from the market, but it is still possible to place orders running up to 500 tons for delivery from January to March. Owing to the idleness of several local stacks on account of the low prices, active Northern furnaces selling in this district are well sold ahead. There has been no change in prices, however, during the week. Low grade irons have been in brisk demand, and Southern producers report they have orders for several thousand tons pending, principally for Nos. 3 and 4. We continue to quote as follows:

| | |
|---|---|
| Lake Superior Charcoal | $16 50 to 17 00 |
| Northern Coke Foundry No. 1 | 15 00 to 15 50 |
| Northern Coke Foundry No. 2 | 14 50 to 15 00 |
| Northern Coke Foundry No. 3 | 14 00 to 14 50 |
| Northern Scotch Foundry No. 1 | 15 50 to 16 00 |
| Ohio Strong Softeners No. 1 | 16 80 to 17 30 |
| Ohio Strong Softeners No. 2 | 16 30 to 16 80 |
| Southern Coke Foundry No. 1 | 13 85 to 14 35 |
| Southern Coke Foundry No. 2 | 13 35 to 13 85 |
| Southern Coke Foundry No. 3 | 12 85 to 13 35 |
| Southern Coke Foundry No. 4 | 12 35 to 13 10 |
| Southern Gray Forge and Mottled | 12 35 to 12 85 |
| Southern Silveries (4% to 6% Silicon) | 16 50 to 17 50 |
| Jackson Co. Silveries (8% to 10% Silicon) | 18 50 to 19 50 |
| Alabama and Georgia Car Wheel | 19 85 to 20 85 |
| Malleable Bessemer | 14 50 to 15 00 |
| Basic Iron | 14 35 to 14 85 |

**Iron and Steel Bars.**—Little new business has developed during the week under review, and the market has continued without change. The activity of railroads in the matter of purchases of new cars will no doubt increase the orders and specifications from these sources, and with the turn of the year a marked improvement in trade is expected. We quote iron bars, 1.30c to 1.35c Chicago, carload lots, mill shipments, half extras. Steel bars, 1.46½c half extras, Chicago delivery, carload lots, mill shipments, with 5c to 10c extra for less than carload lots; angles, less than 3 x 3, 1.56½c base, half extras; hoops, 1.81½c carload lots, full extras. Jobbers' quotations on carload lots and less: Iron, 1.60c to 1.75c base full extras; steel, 1.60c to 1.70c; small angles, channels and tees, less than 3 x 3, 1.70c to 1.80c; hoops, 2.10c rates, full extras.

**Billets.**—Mills report that a few orders for small lots have been closed during the week, the market, generally speaking, being without interest. We quote the official

schedule of $24 Chicago, carload lots on open-hearth and Bessemer billets, either for rolling or forging.

**Sheets.**—Demand has been light during the week under review, the holidays interfering with sales. Prices on black sheets are $1 lower than a week ago, and galvanized sheets are also weaker. We quote black sheets, carload lots, mill shipments: No. 27 gauge, 2.41½c to 2.46½c; No. 28, 2.46½c to 2.51½c; galvanized from mill, 80 and 2½ percent off. Store prices are without change, and we quote as follows: No. 16, 2.45c; Nos. 18 and 20, 2.55c; Nos. 22 and 24, 2.60c; No. 26, 2.70c; No. 27, 2.80c; No. 28, 2.90c; galvanized from store, 75 and 7½ percent.

**Plates.**—There has been an improvement in buying since the announcement of the change in the method of basing prices, which goes into effect Jan. 1. During the week, contracts have been closed by one interest aggregating 5,000 tons, and specifications on old contracts have also greatly increased. The situation has improved to such an extent that it is the present intention to start up next week the plate mill at South Chicago, which has been shut down for several days. We quote for the last time mill shipments, Chicago delivery, as follows: Tank steel, ¼-inch and heavier, 1.75c; flange steel, 1.85c. From store, we quote small lots, tank steel, ¼ inch and heavier, 1.90c to 2c; 3-16, 2c to 2.10c; No. 8, 2.10c to 2.20c; No. 10, 2.15c to 2.25c; flange steel, 2.25c, all f. o. b. warehouse.

**Structural Steel.**—There has been no noteworthy change since our last report, the demand for structural shapes being very quiet during the week under review. Prices are without change, and we quote mill shipments, Chicago delivery, as follows: Beams and channels, 16 inches and under, 1.76½c; 18 inches and over, 1.86½c; universal plates, 1.75c; angles, 3 x 3 and larger, 1.76½c; tees, 3 x 3 and larger, 1.81½c; zees, 1.76½c. On lots from store, we quote beams, channels and angles, 3 x 3 and larger, 1.90c rates; 18, 20 and 24-inch, 10c extra; tees, 1.95c rates.

**Merchant Steel.**—There has been an improvement in demand during the week, a number of implement people covering for needs in the first half of next year. Specifications are also increasing, and the outlook generally is much brighter. We quote mill prices, Chicago delivery: Spring steel, 2c; sleigh shoe, flat sizes, 1.60c; concave and convex, 1.75c; cutter shoe, 2.25c to 2.30c; smooth finished machinery steel, 1.71½c base; plow steel, 2.50c and upwards, according to quality; toe calk, 2.01½c to 2.11½c. Ordinary grades of tool steel, 6c to 8c; specials, 12c and upwards. Cold rolled shafting in carload lots, 52, and in less than carload lots, 47 percent discount from list.

**Merchant Pipe.**—The demand has been fair, the principal improvement being in the large increase of inquiries from jobbers. Prices are unchanged and we quote to consumers, carload lots, mill shipments, random lengths, f. o. b. Chicago, as follows:

| | Steel Pipe. | | Guaranteed Wrought Iron Pipe. | |
|---|---|---|---|---|
| | Black. Percent. | Galv. Percent. | Black. Percent. | Galv. Percent. |
| ⅛ to ⅜ inch inclusive..... | 66.35 | 56.35 | 63.35 | 53.35 |
| ½ inch ..... | 68.35 | 58.35 | 65.35 | 55.35 |
| ¾ to 6 inches ..... | 73.35 | 63.35 | 70.35 | 60.35 |
| 7 to 12 inches inclusive ... | 67.35 | 57.35 | 64.35 | 54.35 |

Less than carload lots, 12½ percent advance over above prices.

**Boiler Tubes.**—Mills have put into effect a new schedule of prices, which are given below, the quotations being for carload lots from mill, Chicago delivery:

| | L. W. Steel. Percent. | C. C. Iron. Percent. | Seamless Steel. Percent. |
|---|---|---|---|
| 1 to 1½ in..... | 42.35 | 39.85 | 53.35 |
| 1¾ to 2¼ in..... | 54.85 | 37.35 | 40.35 |
| 2½ in. ..... | 57.35 | 42.35 | ..... |
| 2¾ to 5 in..... | 63.35 | 49.85 | { Up to 4 inches. |
| 6 to 13 in..... | 54.85 | 37.35 | { 48.35 |

For car lots or less, direct from warehouse stock:

| | L. W. Steel. Percent. | C. C. Iron. Percent. | Seamless Steel. Percent. |
|---|---|---|---|
| 1 to 1½ in. ..... | 40 | 35 | 37.50 |
| 1¾ to 2½ in. ..... | 50 | 32.50 | 35 |
| 2¾ to 5 in..... | 60 | 45 | { Up to 4 inches. |
| 6 to 13 in. ..... | 50 | 32.50 | { 45 |

**Cast Iron Pipe.**—Prices are 50 cents a ton lower, which is the only new development to report this week. Demand is light and limited to small lots. We quote carload lots, f. o. b. Chicago: 4-inch water pipe, $27.50; 6-inch and upwards, $26.50; gas pipe $1 a ton higher.

**Rails and Track Supplies.**—A good demand is in evidence for light rails and track supplies, but heavy sections are quiet. We quote standard rails, 500 tons and over, $28; less than 500 tons to carload lots, $30; less than carload lots, $32; second quality rails, $27; 25-pound rails, $26 to $28; 12-pound rails, $28 to $30, with regular differentials for intermediate sizes. Track supplies, mill shipments, angle bars, 1.70c to 1.80c; spikes, first quality, 1.85c to 1.95c (out of store, 2.10c to 2.20 rates); second quality, 1.55c to 1.65c; track bolts, 3½ x ¾, with square nuts, 2.40c to 2.50c per 100 pounds (from store, 2.80c to 2.90c); with hexagon nuts, 2.55c to 2.65c (from store, 3c), with usual differentials for other sizes.

**Wire Products.**—The leading producer has met the cuts of the independent makers by announcing a reduction in its prices of $3 a ton on wire nails, barbed and smooth wire, etc. It is understood, however, that the lower price is being made only to favored customers and will be withdrawn as soon as these have covered. We have revised our quotations, and quote prices to jobbers, Chicago delivery, as follows: Wire nails, carload lots, $2.00; cut nails, steel, carload lots, $2.06½; plain wire, $1.90 carloads, and $2 in smaller lots; galvanized plain wire, carloads, $2.20; smaller lots, $2.25. Painted barb wire, carloads, $2.30; less than carloads, $2.35; galvanized, carloads, $2.65; less than carloads, $2.70; staples, carloads, $2.15; smaller lots $2.20; galvanized, carloads, $2.55; smaller lots, $2.60. Bale ties, 82½ and 5 percent discount f. o. b. Waukegan on straight carload lots. Poultry netting, 85 and 5 percent discount from list f. o. b. Joliet or De Kalb with actual freight allowed not exceeding 50 cents per 100 pounds.

**Foundry Coke.**—Demand for coke continues to improve and some good sized contracts have been closed during the week. Frick coke is held firm at $2.65 at the ovens, and other grades of Connellsville from $2.25 up at the ovens. New River and Pocahontas grades range from $4.75 to $5.15 Chicago.

**Old Material.**—There has been some demand from mills during the week, although the tonnage closed is not very large. Country offerings are scarce in this market, dealers generally withholding their material on account of low prices. Railroads, however, are disposing of their supply at current market prices. Quotations have taken on a firmer tone during the week, though no change from those given below is announced. We quote dealers' selling prices, gross tons, as follows:

| | |
|---|---|
| Old iron rails | $14 00 to 14 50 |
| Old steel rails (mixed lengths) | 9 00 to 9 50 |
| Old steel rails (long lengths) | 10 50 to 11 00 |
| Relaying rails | 23 00 to 24 00 |
| Old wheels | 11 50 to 12 00 |
| Heavy melting steel | 9 00 to 9 50 |
| Mixed country steel | 7 00 to 7 50 |

The following are selling prices for net tons:

| | |
|---|---|
| No. 1 R. R. wrought | $10 00 to 10 50 |
| No. 2 R. R. wrought | 8 50 to 9 00 |
| Shafting | 11 00 to 11 50 |
| Dealers' forge No. 1 | 9 00 to 9 50 |
| No. 1 busheling and wrought pipe | 7 50 to 8 00 |
| No. 1 cast | 10 50 to 11 00 |
| Heavy cast (300 pounds and over) | 8 00 to 8 50 |
| Agricultural malleable | 9 00 to 9 50 |
| Iron axles | 14 00 to 14 50 |
| Steel axles | 11 50 to 12 00 |
| No. 1 boilers, cut | 7 50 to 8 00 |
| Cast borings | 3 00 to 3 50 |
| Mixed borings, etc. | 3 00 to 3 50 |
| Wrought turnings | 6 00 to 6 50 |
| Machine shop turnings | 6 00 to 6 50 |
| Iron axle turnings | 6 50 to 7 00 |
| Steel axle turnings | 6 00 to 6 50 |
| Stove plate and light cast scrap | 8 50 to 9 00 |
| Old iron splice bars | 10 50 to 11 00 |

## CLEVELAND.

OFFICE OF *The Iron Trade Review*, 1064 ROSE BUILDING, Dec. 29.

The week between Christmas and New Year's is usually a dull period and it has been this year in pig iron, but sales of finished material have been rather larger than was expected, although jobbers have not received many orders.

**Iron Ore.**—Not for years have orders for shipment of ore from docks come so slowly; in fact, almost no ship-

ments are being made. Furnaces, as a rule, have ample supplies in their yards. It is not probable that prices of ore for next year will be fixed before April 1, as it is recognized that even if prices were sharply reduced, no ore would be sold. Hence the ore companies prefer to await developments in the iron world.

**Pig Iron.**—The market in Northern iron is very quiet. The usual price in the Valley is $13, or $13.85, Cleveland. Northern Ohio furnaces are getting somewhat higher prices, the usual quotation being $13.50 at the furnace, but this price is shaded, especially when it is necessary to meet Southern competition. Foundries report better prospects for business than for some time. A number in this district are figuring on furnishing 4,200 tons of counterweights of about five tons each for the Cincinnati waterworks. Reports concerning the Southern situation are somewhat conflicting as to prices, but $9.50, Birmingham, for No. 2 is apparently the bottom price at present, while some Southern furnaces decline to accept less than $10 for first quarter business. Large sales made within a few weeks have caused several of the large companies to advance their quotations. Efforts of Southern producers to form a new association to maintain prices have been futile, although it is understood that at a meeting held in Birmingham a few days ago all present, representing nearly all the principal Southern interests, were of the opinion that the $9.50 quotation ought not to be shaded. We quote as follows for Cleveland delivery, save on Northern gray forge, which is at Valley furnace:

| | |
|---|---|
| Bessemer | $14 00 to 14 50 |
| No. 1 Strong Foundry | 14 00 to 14 50 |
| No. 2 Strong Foundry | 13 25 to 14 00 |
| No. 3 Foundry | 12 75 to 13 50 |
| No. 2 Southern | 13 35 to 13 85 |
| Gray Forge, Valley furnace | 12 50 to 12 75 |
| Gray Forge, Southern | 11 85 to 12 00 |
| Lake Superior charcoal | 16 50 to 17 00 |

**Finished Material.**—Business in steel bars at 1.30c for Bessemer and 1.40c for open-hearth, Pittsburg, has been good on new orders and a number of long contracts have been placed. Another order for ship plates has been placed. There is a fair business in light rails, but rerolling mills have been very active in competition and have been able to get some orders at lower figures than those at which new rails can be sold. The bar iron trade is pretty badly demoralized. Although the principal producers are quoting 1.30c, Youngstown, and local mills are quoting 1.30c at their plants, Western mills have sold bar iron delivered in Cleveland at 1.30c, which would be equivalent to 1.17c at their mills. Such sales are not frequent and the mills are not able to furnish all sizes, but the transactions are nevertheless a disturbing element. Sales of sheets at the prices of the principal producer are very limited and independent producers are cutting prices quoted below from $2.50 to $3 per ton. We quote mill sales of black sheets as follows: No. 10, 1.75c; No. 11-12, 1.80c; No. 14, 1.85c; No. 16, 1.95c; No. 27, 2.30c; No. 28, 2.40c. Galvanized, 75, 10 and 7 off. Out of stock prices are as follows: No. 10, 2.10c; No. 12, 2.15c; No. 14, 2.20c; No. 16, 2.30c; No. 18-20, 2.40c; No. 24, 2.45c; No. 25-26, 2.50c; No. 27, 2.55c; No. 28, 2.65c; No. 30, 3.10c. Galvanized out of stock, No. 16, 75 and 7½ off; No. 18-20, 75 and 10 off; No. 22-28, 75, 10 and 2½ off.

**Old Material.**—There is much more inquiry and prospects are encouraging. Steel rails, over six feet, heavy steel, machine cast scrap, iron axles and cast borings are from 50c to $1 higher. We quote the following gross tons, Cleveland:

| | |
|---|---|
| Old iron rails | $15 00 to 16 00 |
| Old steel rails (over 6 feet) | 11 00 to 12 00 |
| Old steel rails (6 feet and under) | 11 00 to 12 00 |
| Old car wheels | 13 00 to 14 00 |
| Steel boiler plates | 9 00 to 10 00 |
| Malleable iron (railroad) | 11 00 to 12 00 |
| Malleable iron (agricultural) | 9 00 to 10 00 |
| Heavy steel | 10 00 to 11 00 |

We quote the following net tons:

| | |
|---|---|
| No. 1 R. R. wrought | $11 50 to 12 00 |
| Mill scrap | 9 00 to 10 00 |
| No. 1 machine cast scrap | 11 00 to 12 00 |
| Iron axles | 15 00 to 16 00 |
| Axle turnings | 9 00 to 10 00 |
| Wrought turnings (free from cast) | 6 00 to 7 00 |
| Uncut wrought iron boilers | 5 00 to 6 00 |
| Grate bars | 6 00 to 7 00 |
| Pipes and flues (clean) | 8 00 to 9 00 |
| Tank iron | 8 00 to 9 00 |
| Hoop and band iron | 5 00 to 6 00 |
| Sheet iron | 4 00 to 5 00 |
| Wrought drillings | 6 00 to 7 00 |
| Stove plate | 8 50 to 9 00 |
| Steel axles | 13 00 to 14 00 |
| Cast borings | 3 00 to 4 00 |

## CINCINNATI.

Dec. 29.

The week between the holidays has not been productive of developments and the general situation shows no important change. The coke market is quiet with an easy undertone and prices range from $2 f. o. b. ovens up to $2.40 for the best brands.

**Pig Iron.**—The market is in an unsettled condition with more irregularity in prices than has prevailed for some time. Some furnaces have advanced their prices to $10 Birmingham while others are still selling at $9.50. A large buyer was in the market at the close of last week and was able to place orders for considerable iron at $9.25 Birmingham. The going inside price today is $9.50 basis. It is not established that any more iron is available at $9.25 although it is said that some bids on this basis have been submitted to furnaces but that no reply has been received as to whether they will be accepted. The $10 quotations are of course out of line and such iron is simply out of the market. It has also developed that for No. 1 foundry some furnaces are asking 75c per ton over the price for No. 2 foundry and that this difference has been obtainable. There is continued weakness reported in Northern iron and $13 Valley furnace and $13.25 Hanging Rock district are reported. No large transactions have been reported this week and the trade is quiet as might be expected in the week between the holidays. The general feeling, however, is not so strong as it was two weeks ago and the selling interests are not looking forward with confidence to higher prices in the first month of the new year. It is argued that considerable iron has been sold and that many consumers have covered their wants for the first quarter and some have taken on enough to carry them well into the second quarter and that the demand which was felt when the market went to $9 Birmingham was the result of deferred business which had been held back waiting for the right time to come in. There is some apprehension that demand will not hold up, especially if an attempt is made to advance prices. There is not much talk of Northern furnaces' competition, but the actions of these interests are being watched.

| | |
|---|---|
| Southern Foundry No. 1 | $12 75 to 13 00 |
| Southern Foundry No. 2 | 12 25 to 12 50 |
| Southern Foundry No. 3 | 11 75 to 12 00 |
| Southern Foundry No. 4 | 11 25 to 11 50 |
| Southern Foundry No. 1 soft | 12 75 to 13 00 |
| Southern Foundry No. 2 soft | 12 25 to 12 50 |
| Gray forge | 10 75 to 11 25 |
| Northern Foundry No. 1 | 14 90 to 15 40 |
| Northern Foundry No. 2 | 14 40 to 14 90 |
| Northern Silvery (8% silicon) | 17 15 to 17 65 |
| Southern car wheel iron | 18 75 to 19 00 |

**Finished Material.**—Trade is reported to be holding up fairly well considering the holiday season and that it is the closing week of the year. No price changes are reported. For bar iron prices ranging from 1.25c up to 1.35c for car lots are quoted. Steel bars remain at 1.43c base, half extras, with the retail price 1.75c for iron and steel out of store. Galvanized sheets are being quoted at 75 and 10 and 5 and 2½ percent off. We quote black sheets, No. 27, at 2.45c in car lots of 500 bundles. Black sheets out of store are selling as follows: No. 28, 2.90c; No. 27, 2.80c; No. 16, 2.55c; No. 14, 2.45; No. 12, 2.35c; No. 10, 2.30c. Tank plates are easy and sell out of store at 2c for ¼-inch and 2.10c for 3-16-inch. Beams and channels are quoted at 1.90c to 2c from stock, and angles at 1.90c to 2c for base sizes.

In merchant pipe there has been no new price list promulgated by the leading interest and independent mills are still underselling the regular price list. In boiler tubes there has been a notice of reduction to take effect

on the first of the year but these figures are not yet given out here. The demand is only fair and the trade is quiet.

MERCHANT PIPE.

(Basing Discounts.)

| | Steel Pipe. Black. Percent. | Steel Pipe. Galv. Percent. | Guaranteed. Wrought Iron Pipe. Black. Percent. | Guaranteed. Wrought Iron Pipe. Galv. Percent. |
|---|---|---|---|---|
| ⅛, ¼, ⅜ inch | 66.7 | 56.7 | 63.7 | 53.7 |
| ½ inch | 68.7 | 58.7 | 65.7 | 55.7 |
| ¾ to 6 inch, inclusive | 73.7 | 63.7 | 70.7 | 60.7 |
| 7 to 12-inch, inclusive | 67.7 | 57.7 | 64.7 | 54.7 |

BOILER TUBES.

| | Steel Percent. | Iron Percent. |
|---|---|---|
| 1 to 1½ inch | 41.2 | 37.7 |
| 1¾ to 2½ inch | 54.2 | 36.7 |
| 2¾ to 5 inch | 59.7 | 46.7 |
| 6 to 13 inch | 54.2 | 36.7 |

**Old Material.**—The market is quiet with no price changes and the recent low quotations still prevail although the largest dealers are still holding for higher figures. We quote:

| | |
|---|---|
| Old No. 1 railroad wrought, net tons | $10 00 to 10 50 |
| Cast machine and foundry, net tons | 10 50 to 11 00 |
| Old iron rails, gross tons | 16 00 to 17 00 |
| Old steel rails, gross tons | 12 00 to 13 00 |
| Old short lengths, gross tons | 10 00 to 11 00 |
| Old iron axles, net tons | 15 00 to 15 50 |
| Stove plate, net tons | 9 00 to 9 50 |
| Wrought turnings, net tons | 6 00 to 6 50 |
| Cast borings, net tons | 4 00 to 5 00 |

## NEW YORK.

OFFICE OF *The Iron Trade Review*,
ROOM 1909, NO. 150 NASSAU ST., Dec. 29.

**Pig Iron.**—While nearly all of the reports that have found their way into print, would indicate that the iron situation in this vicinity, especially for Southern brands, has improved recently, nothing of a substantial character can be obtained to justify them. While it is true that the Tennessee Coal & Iron Co. advanced the price of No. 2 Southern on Thursday to $10, Birmingham, for the first quarter of the new year, it is a fact that several other large interests will still close contracts at $9.50 for the same delivery. One of these companies will not sell more than 500 tons at a time at present prices to any customer, and has also adopted $10.50, Birmingham, as a tentative price for delivery in April. It is also reported from Birmingham that two other furnaces have adopted the $10 Birmingham schedule for No. 2 foundry for delivery the first quarter of 1904. This is the market here on the surface, but sales are made at lower figures. In the week two New Jersey manufacturing concerns were in the market for 2,500 and 500 tons respectively. For the large lot it is known that a bid of $9.35 Birmingham was rejected, and for the small lot one of $9.50 met the same fate. How much below these figures the business was taken is not known. As for the remaining tonnage placed during the week, it represented a very fair amount, ranging from 25 to 500-ton lots, and with $9.50 Birmingham forming the highest basis for any single sale. Advices from Birmingham to local sellers all predict a higher range of values for the new year. It is understood that the December sales of one company are close to 100,000 tons. Of Northern irons, there is nothing of interest to say, as there have been very few sales made, and these indicate that the undertone is ot as strong as it was about 10 days ago. New York pig iron prices are as follows: Northern No. 1 X, $15.25 to $15.75; No. 2 X, $14.50 to $15.50; No. 2 plain, $14.25 to $15; Southern No. 1 foundry, $13.25 to $13.75; No. 2 foundry, $13 to $13.25; No. 3 foundry, $12.25 to $12.75; No. 4 foundry, $11.75 to $12.25.

**Billets.**—Very few sales are reported, and the pool price is being shaded. Shipments from Atlantic ports during the past 10 days have amounted to 2,000 tons, all of them to England. It is said that some of them represent about $13 delivered, after deducting all expenses.

**Finished Iron and Steel.**—There is not a single branch of the finished material market which does not report the week just closing as the dullest of the year. In structural shapes, the leading interest has been advised that railroads will probably provide for their requirements for next year, in the near future, being convinced that present prices will hold. In bars, plates and sheets, the transactions have been meager, and manufacturers are anxiously awaiting the new year's developments in their respective lines. New York prices are as follows: Beams and channels, 15 inches and under, 1.75c to 1.90c; angles, 3 to 6 inches, 1.75c to 1.90c; zees, 1.75c to 1.90c; bulb angles, 2.05c to 2.35c; deck beams, 2.05c to 2.25c; sheared steel plates, tank, 1.75c to 1.80c; flange, 1.85c to 1.90c; firebox, ordinary, 1.95c to 2c; refined iron bars, 1.40c to 1.45c; soft steel bars, 1.40c to 1.50c; steel sheets, in carloads, New York, No. 28 black, 2.45c to 2.55c; galvanized, 75 and 10 to 75 and 5 off.

# The Metal Market.

## NEW YORK.

OFFICE OF *The Iron Trade Review*,
ROOM 1909, NO. 150 NASSAU ST., Dec. 29.

**Pig Tin.**—Speculative interests were very active in both this and foreign markets during the week, and prices here were at one time nearly 1 cent higher than when we last quoted them. Today, however, there was a reaction. The strength the market has developed has been outside the speculative impetus, and is due to a scarcity of spot supplies, which command a higher price than those asked for delivery in the near future. In London, both spot and futures are now up £1 7s 6d over our last quotations. Closing prices at the Metal Exchange today follow: Spot, 28½c to 28.90c; January, 28.25c to 28.75c. London's closings today are: Spot, £130 7s 6d; futures, £131 7s 6d.

**Copper.**—While prices remain the same as when we last quoted them, the dullness during the week was the most pronounced of the year. Reports from consumig centers either tell of commitments being sufficient to last for some time, or of purchases being confined to meet urgent necessities, with lower prices expected by many. In London, trading has been of the most limited character, with prices a shade higher than our last report. Closing prices at the Metal Exchange today follow: Lake, 12⅜c to 12⅝c; electrolytic, 12¼c to 12½c; casting, 12⅛c to 12⅜c. London's closings today follow: Spot, £56 17s 6d; futures, £56 10s. Exports for the month to date aggregate 13,539 tons, against 8,832 tons for a similar period last year.

**Lead.**—Spot continues scarce and strong at 4⅜c, with 50-ton lots, 30 days' delivery, at 4¼c. St. Louis is firmer at 4.17½c to 4.20c. London is unchanged at £11 3s 9d.

**Spelter.**—Spot is unchanged at 5c, with January at 4.90c St. Louis is stronger at 4.75c, and London is unchanged at £21 7s 6d.

**Antimony.**—Cookson's is 7¼c, Hallett's 6¼c, and outside brands 5¾c.

**Quicksilver.**—Is quoted at $46.50 to $47.50 per flask of 76½ pounds in lots of 100 flasks. London is £8 5s.

**Nickel.**—Is selling at 40c to 47c for large lots down to a ton, and 50c and 60c for smaller quantities.

## CHICAGO.

OFFICE OF *The Iron Trade Review*,
1115 MONADNOCK BLOCK Dec. 29.

There is considerable improvement in the demand for metals in this market, the buying of the week including some orders for requirements well into the new year. Lead is sustaining its recent advance, and copper is fractionally higher. Spelter and tin are without change though prices are very firm. Quotations on Lake copper, carload lots, Chicago, are 12⅝c, and in small lots, 13c to 13½c; casting, carload lots, 12⅜c; smaller quantities, 13c to 13¼c. Tin is quoted at 29½c in small lots. Pig lead, 4.32½c in carloads, and 4¾c in lesser lots. Spelter, 5c carloads, and 5¾c to 6c for small lots. Antimony, 7¼c for Cookson's and 6½c to 6¾c for Hallett's in small quantities. Nickel is 45 to 60c, according to amount and deliveries.

The demand for old metals is improving in sympathy with the tone in new metals. We quote dealers' selling prices as follows: Copper wire, $10.75; copper, heavy, $10.50; light copper, $9.50; red brass, $9.50; red brass turnings, $8.00; yellow brass, $7.00; yellow brass turnings, $6.00; lead, $3.75; zinc, $3.25.

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The recently incorporated Meeker Foundry Co., Newark, N. J., contemplates taking over the business of S. J. Meeker, which Henry A. Potter has been running for some time, as trustee.

## CAR AND LOCOMOTIVE BUILDING IN 1903.

Official returns to the *Railroad Gazette* from all but two car building plants in the United States, show that 154,808 cars have been built during the year 1903. As the two firms from which the *Gazette* has not heard turn out a total of less than 2,000 cars, it has estimated their output from its own record of their work and added the sum obtained to the above total. This figure includes all freight and passenger cars built for elevated and steam railroads, exclusive of those built by the railroads at their own shops, and exclusive of those built for street and other electric service. Careful estimates have been made by all the large car plants for their output during the month of December, so the total given above is very nearly correct. Of this total figure, approximately 152,801 are freight cars and 2,007 are passenger coaches; 153,195 for domestic use and 1,613 for export. Last year the total number of cars built was 164,547, which is about 9,700 in excess of this year. The decrease has occurred in the last two months, as up to that time the output for 1903 was equal to the output for the first ten months of 1902.

During the year 5,152 locomotives were built at the various locomotive works in the country, as against 4,070 last year. This figure is officially correct, as complete returns have been received from every locomotive building plant in the United States. The number includes 88 electric locomotives. The increase over 1902 is the largest that has ever occurred in one year, and is possibly due to the fact that the locomotive works in the country had such a volume of orders placed during 1902, that they were unable to make immediate deliveries, and many of the orders were held over until 1903. Returns from Canada show that 55 locomotives have been built by two firms, one of which has only recently begun operations. In analyzing the report it is interesting to note what this total of 5,152 really means, by calculating the expenditure involved. At an average cost per locomotive of $12,000, the total amount spent by the railroads for motive power would be approximately $62,000,000. This figure of course does not include the locomotives which are built yearly by railroad companies at their own shops. The following table shows our figures for locomotive building during the last 12 years:

| | | | |
|---|---|---|---|
| 1892 | 2,012 | 1898 | 1,875 |
| 1893 | 2,011 | 1899 | 2,473 |
| 1894 | 695 | 1900 | 3,153 |
| 1895 | 1,101 | 1901 | 3,384 |
| 1896 | 1,175 | 1902 | 4,070 |
| 1897 | 1,251 | 1903 | 5,152 |

Referring to a reduction in wages on Jan. 1, affecting most departments of the Jones & Laughlin Steel Co.'s operations, President B. F. Jones is thus quoted: "A reduction will be made, taking effect Jan. 1. This reduction has been agreed to by all our employes affected, the men realizing the necessity of a reduction. In a few cases a change will be made from an eight to a twelve-hour turn. This, however, affects only a small number of our men. The 12-hour turn has been in effect in similar positions for years in all other mills."

The Bessemer plant of the Republic Iron & Steel Co., Youngstown, O., again resumed operations this week. This plant has been operating intermittently for several months.

Stack No. 3 of the Duquesne plant of the Carnegie Steel Co. was blown in this week after an idleness extending over about three months. Furnace H. of the Edgar Thomson plant will be blown in early next week, while four other stacks at this plant will go into commission next week. Two furnaces at the Carrie plant, Rankin, Pa., will also be blown in. The blowing in of these furnaces will be followed by resumptions at several of the idle steel plants of the Carnegie Steel Co.

At a meeting of manufacturers of shafting held in Cleveland, Dec. 29, present prices were reaffirmed.

## OBITUARY.

Frederich Wm. Martino, an inventor, who died of apoplexy in Sheffield, Eng., Oct. 7, was the inventor of the breech action for rifles which superseded the Snider in the early seventies. This was the block and lever system. His most serviceable contribution to science is in connection with extraction of nickel from ore. Another discovery brought about the conversion of basic slag into manure. Mr. Martino was some years ago in business in Sheffield as a manufacturer of nickel.

Henry W. Mans Sr., a well-known manufacturer, of Eastern Pennsylvania, died Dec. 27, aged 65. He founded the Hazleton Iron Works at Hazleton, Pa.

H. Herbert Andrew, head of the firm of J. H. Andrew & Co., Sheffield, Eng., died in New York Oct. 13. Mr. Andrew was one of the most prominent figures in the steel trade of Sheffield, and much of the expansion of the business with which he was connected was due to his own personal efforts. He developed a very valuable business connection in the United States, where he was well known.

Maj. Malcolm McDowell, of Chicago, well known throughout the country as an expert in foundry and rolling mill practice, died suddenly Christmas night from a fit of coughing. Deceased was in good health up to within an hour or so of his death, having spent Christmas day at the home of his daughter. Maj. McDowell leaves a widow and the following children: Malcolm McDowell, secretary of the Central Trust Co. of Illinois; Irwin McDowell, of the Field-Evans Iron Co., Chicago; Hanson McDowell, of the Hodge Iron Co., Houghton, Mich.; Miss Mary E. McDowell and Mrs. Herman B. Powers. He was the inventor of the steel plow beam, and also of several appliances used in rolling mills and foundries. A more extended review of his life will be given later.

As the result of the issuing of a writ by the American Trust Co. against the Cramp Steel Co., whose works are located at Collingwood, Ont., operations have been suspended. Major Currie, secretary of the company, states that it is not, strictly speaking, closed down, but that the building of the plant has been finished and that, before commencing to manufacture, it will be necessary to make financial arrangements for working capital and to adjust liabilities. He states that strong financial interests have taken the matter up and that it is hoped the necessary capital will soon be obtained.

The closing of the Illinois Steel Co. plant at South Chicago has thrown 6,500 men out of employment. On Dec. 24 the following notice was posted: "Jan. 1 there will be an adjustment of wages without prejudice to existing contracts. Individual rates can be obtained the first of the year through inquiry of the timekeepers." It is not known how long the plant will remain idle, but an official states that he hopes to have some of the departments in operation early in the new year. Repairs will require the service of 1,000 skilled machinists and electrical workers.

Bollinger & Rieley, Cleveland, builders of ice and refrigerating machinery, have a considerable number of contracts on their books at the present time. Among the larger is a complete refrigerating equipment for the Galion Brewing Co., Galion, O. This equipment consists of a 25-ton ammonia compressor coupled to a 12 x 36-inch Corliss engine, direct expansion pipe for all storage rooms, condensers, pumps, tanks, attemperater coils and beer coolers. At St. Vincent's hospital, Cleveland, they are placing a complete 10-ton combination ice and refrigerating plant. Their prospects for the immediate future are bright and they are sure of keeping their entire force at work for at least three months.

The Pressed Steel Car Co., Pittsburg, will close its fiscal year on Dec. 31, and the net earnings of the year, after deducting fixed charges and preferred dividends will amount to about $1,600,000, as compared with $3,403,114 the previous year.

The Haselton, O., plant of the American Bridge Co. is not to be dismantled, although a majority of the company's existing plants will be dismantled as soon as the plant at Ambridge, Pa., is placed in full operation.

# THE IRON TRADE REVIEW

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## REVIEW AND OUTLOOK.

At the moment the future of the iron market is of more interest than any review of the year just closing. But conditions in 1903 cannot be ignored in any reference to 1904, for the past year has been distinctly transitional. The strain and friction of 1902, when railroads and iron manufacturers staggered under the load of business piled upon them, still existed in early 1903; but in the second half of the closing year these have passed away, and 1904 will show to what the transition has led.

In spite of the drastic reduction in pig iron output which has marked the last quarter of the year, 1903 promises to show a new record of production. This is owing to the tremendous pace of the first six months, in which production amounted to 9,707,367 gross tons. For the year the official total will not vary greatly from 18,000,000 tons, as against 17,821,307 tons in 1902. Entering the year with production at the yearly rate of 18,400,000 tons, which at high point on June 1 was at the rate of 20,700,000 tons, the iron trade closes 1903 with production at an annual rate of about 12,700,000 tons. While in December, 1902, we imported 118,373 tons of pig iron and in January, 1903, 110,679 tons, the import trade today is practically nil and British furnacemen are bravely over the idea entertained early in 1903, of contesting for the Eastern foundry trade.

The feeling in the iron trade at the opening of 1903 was highly optimistic. It was understood that new capacity in blast furnaces and finishing mills under construction in the two preceding years might make itself felt in the next twelvemonth, but it was argued that it might simply displace foreign material, and was really needed. And even when the stock market situation became acute in May and June, there were many who doubted the ability of the forces then at work in the East to affect the consumption of iron. But the change has come. No matter how much undigested securities and reckless speculation have done, or how much the building strikes and the ill-considered demands of organized labor, the change has come. Idle furnaces and idle mills are proofs that cannot be gainsaid.

Demand is the final arbiter of production and prices; but as always there has been in the past year the factor of associated effort by manufacturers. In 1902 the producers of rails, structural material, plates and steel bars maintained prices on a reasonable level, though much higher prices could have been had. Through the changing conditions of 1903, with non-association products falling—sheets declining $8 a ton, bar iron $11 a ton, and Southern pig iron $9.50 in the year—prices on association products have been maintained, with the exception of steel bars, which were reduced $6 a ton in November. In Southern pig iron, the leading producers have been as unsuccessful in their effort to keep prices up in 1903 as they were in 1902 to keep them down. Nothing better illustrates the change in conditions.

Naturally the projection of new iron and steel plants is today practically a dead industry. The heroic effort now being made by the United States Steel Corporation to dispose of some of its surplus abroad at figures that scarcely cover cost—prospects being that about 1,000,000 tons a year can be marketed in this way—emphasizes the over supply of steel works. Many companies with finishing mills, and dependent on the market for their steel supply, have had serious difficulties in the year. A number have failed, and others have ceased operations for the time. The drift of business into the hands of large producers is more marked. And among the large steel companies, those which undertook important extensions under the stimulus of the boom, have had trying problems to meet in the year, with the certainty that others equally trying must be dealt with in a period of lower prices and sharp competition for tonnage.

With all the disappointments of the closing year the iron trade enters upon 1904 hopefully, at least; and there is good reason to expect an improvement from the conditions of the past three months. What the railroads do will determine largely the turn of events. With a total of 2,200,000 tons of rails booked for 1903 or carried over from 1902, the rail manufacturers faced 1903 with abundant confidence. Today they have scarcely more than one-third that tonnage. If the supply of money increases and a market for bonds again appears, so that new work can be financed on favorable terms, the railroads will resume buying iron and steel where they left off some months ago. In other consuming lines there is good evidence that the wait of recent months has been rather for a lower price than for lack of uses for material, and much withheld buying will come out now because it cannot be longer delayed. Indeed, enough business has accumulated in the period of abstention from the market to warrant considerably increased operation of steel works in January. Moreover, the great consuming West, with its unprecedented bank accounts and its millions of bushels of grain not yet turned into money, has a buying capacity that should be heard from in 1904.

But with all the expectation of improvement in the iron trade on the coming in of the new year, the uppermost question is how far our enormous capacity is to be employed. It remains to be seen whether the consumer considers the present basis of prices to be one on which he can buy freely. If idle furnaces and steel works

start again, now that wages and fuel costs have been reduced, will there be business enough to go around? Thus the question of the right price will dominate the situation just as really after the line has been crossed into 1904, and in answering it pools and associations no less than the individual buyer must depend greatly upon the light of events.

## THE IMPORT AND EXPORT MOVEMENT.

The November exports and imports of iron and steel, as reported by the Department of Commerce, show some movements which while not important were hardly to be expected. The total tonnage of exports shows a decrease of nearly 2,300 tons as compared with October, and brings the total for 11 months to only 23 percent above the corresponding total last year. Evidently the new export movement had not gained any appreciable force in November. The considerable tonnage of sheet bars sold in England in the latter part of October of course has not begun to figure as yet.

The total value of imports of iron and steel, excluding ore, but including a number of lines in which the tonnage is not ascertainable, was $2,309,233 for November, against $2,552,380 in October and $4,779,093 in November a year ago. The total value for 11 months is $39,513,847 against $36,766,961 a year ago, showing an increase, and $18,267,862 two years ago, in which comparison the decrease is marked.

As the imports do not show the decrease that might be expected, so also the exports do not show an increase. The November value, excluding ore but including machinery and other items of which the tonnage cannot be returned, was $7,988,415, against $8,982,426 in October and $8,119,274 in November a year ago. For the 11 months the total value has been: 1903, $89,685,201; 1902, $90,136,024; 1901, $94,112,782.

The detailed exports of which the tonnage is ascertained are as follows:

EXPORTS OF IRON AND STEEL FROM THE UNITED STATES—GROSS TONS.

| | November | | 11 mos. end'g Nov. | |
|---|---|---|---|---|
| | 1902. | 1903. | 1902. | 1903. |
| Pig iron | 1,703 | 1,777 | 26,277 | 15,311 |
| Scrap | 858 | 898 | 9 040 | 5,289 |
| Bar iron | 239 | 2,083 | 19,192 | 19,019 |
| Wire rods | 2,953 | 818 | 21,198 | 21,344 |
| Steel bars | 450 | 578 | 8,693 | 14,080 |
| Billets, ingots and blooms | 220 | 296 | 2,469 | 1,380 |
| Hoop, band or scroll iron | 76 | 320 | 1,546 | 1,941 |
| Iron rails | .... | 4 | 210 | 147 |
| Steel rails | 1,588 | 5,140 | 66,854 | 23,130 |
| Iron sheets and plates | 118 | 131 | 3,235 | 4,632 |
| Steel sheets and plates | 1,681 | 1,611 | 13,984 | 11,738 |
| Tin plates, terne plates and taggers' tin | 103 | 33 | 1,530 | 203 |
| Structural material | 1,993 | 2,614 | 5',776 | 27,707 |
| Wire | 7,503 | 10,355 | 91,579 | 29,560 |
| Cut nails | 621 | 473 | 6,701 | 8,195 |
| Wire nails | 1,799 | 3,905 | 24,144 | 29,514 |
| Other nails, including tacks | 355 | 139 | 1,899 | 2,062 |
| Total | 22,260 | 31,165 | 350,267 | 285,2.2 |

As noted, the total tonnage in November shows a slight decrease over October. Decreases were made in scrap, wire rods, steel bars, steel rails, wire, and cut nails. Increases were made in pig iron, bar iron, billets, hoops, etc., steel sheets and plates, structural material and wire nails. The total tonnage for 11 months falls nearly 20 percent below the similar period last year, due to greatly decreased pig iron, rail and structural exports. These decreases all occurred, however, in the early part of the calendar year. Thus, rails show a decrease, comparing the 11 months, of 43,724 tons, but in the first seven months of the year there had been a decrease of 49,614 tons, so that in the four months August-November inclusive there was an increase of some 6,000 tons.

Exports of tin plate figure even less prominently this year than they did last, the quantity being 203 tons in 11 months this year against 1,530 tons in 1902. The "rebate" tin plate business, of which the American Tin Plate Co. has captured a considerable share in connection with the special wage concession, does not figure in these statistics at all, as such plate goes out as containers for goods returned purely as value under oil, fruit, fish, etc. In the returns of imports a glimpse of the movement is seen, in that only 44,859 tons of tin plate were imported in the 11 months of this year against 51,264 tons in 11 months last year. These imports are of course practically altogether for this rebate trade. The full tonnage table of imports follows:

IMPORTS OF IRON AND STEEL TO THE UNITED STATES—GROSS TONS.

| | November | | 11 mos. end'g Nov. | |
|---|---|---|---|---|
| | 1902. | 1903. | 1902. | 1903. |
| Pig iron | 100 400 | 18,765 | 507,010 | 584,855 |
| Scrap | 10,502 | 2,457 | 97,361 | 80,396 |
| Bar iron | 2,479 | 2 452 | 35,509 | 39,284 |
| Iron and steel rails | 8,107 | 3 395 | 57.495 | 93,488 |
| Hoop, band or scroll | 38 | 33 | 3,231 | 1,519 |
| Steel ingots, slabs, billets or bars | 41,077 | 6,580 | 263,088 | 260.133 |
| Sheets and plates | 970 | 3,051 | 6,133 | 11,211 |
| Tin and terne plates | 4,087 | 4,711 | 51,264 | 44,859 |
| Wire rods | 1 915 | 1,977 | 18,607 | 19,012 |
| Wire and wire articles | 371 | .86 | 3,173 | 4,539 |
| Total | 169,946 | 43,806 | 1,032,871 | 1,139,296 |

November thus shows an enormous drop in tonnage as compared with November of last year, the total being only a trifle over a fourth as great, due to a drop in pig iron from 100,400 tons to 18,765 tons, in scrap from 10,502 tons to 2,457 tons, in crude steel from 41,077 tons to 6,580 tons, and so on. Compared with October, November shows but the slight decrease of 3,148 tons, due entirely to scrap, bar iron and crude steel, and not at all to pig iron.

Presumably these monthly reports will now begin to show the new export movement, reflected in heavy exports of crude steel and scrap, special efforts being made to export these lines. Wire products, plates, shapes, etc., are also likely to show early increases.

The monthly import movement in pig iron and crude steel is shown below:

IMPORTS OF PIG IRON AND CRUDE STEEL, GROSS TONS:

| | 1902 | | 1903 | |
|---|---|---|---|---|
| | Pig Iron. | Steel. | Pig Iron. | Steel. |
| January | 7,833 | 5,312 | 110,679 | 38,691 |
| February | 8,307 | 2,335 | 45,187 | 20,151 |
| March | 17,184 | 6,570 | 59,628 | 31,464 |
| April | 19,067 | 13,005 | 99,944 | 29,014 |
| May | 30,708 | 24,388 | 57,139 | 26,389 |
| June | 32,458 | 35,588 | 79,874 | 30,530 |
| July | 62,156 | 36,124 | 38,046 | 33,070 |
| August | 79,447 | 39,027 | 40,475 | 20,380 |
| September | 82,196 | 27,726 | 16,414 | 13,530 |
| October | 67,204 | 32,036 | 18,704 | 10,343 |
| November | 100,400 | 41,077 | 18,765 | 6,580 |
| | 507,010 | 263,088 | 584,855 | 260.133 |

## Revised Discounts on Wrought Pipe.

(Special Telegram.)

PITTSBURG, Dec. 30.—A largely attended meeting of the independent wrought pipe manufacturers was held at the Hotel Lincoln yesterday and a revised list of discounts was drawn up and adopted which is almost the same as that announced this week by the National Tube Co. More manufacturers were in attendance than at any previous meeting and every effort will be made to maintain uniform prices.

Employes of the Carnegie Steel Co. and Jones & Laughlins Steel Co. have been notified of reductions in wages effective Jan. 1.

# The Labor Situation.

### IMPORTANT TEST CASE IN CINCINNATI.

The Contractors' Association of Cincinnati has made application to the superior court for an injunction restraining the plumbers' union from interfering with its members in their employ who are in arrears in their dues. This action is intended as a test of the right of the unions of that city to order strikes for any disciplinary purpose, when there is no disagreement with the employers or violation of contracts. The brief of Chas. F. Williams, attorney for the plaintiff, is exhaustive, with citation of precedents covering all important cases bearing on the present issue. In concluding his brief, Mr. Williams says:

"Upon the consideration of the principles involved, I submit that the injunction as originally drawn was properly granted and should be sustained. The counsel for defendants seems to have misapprehended the real point at issue. The right of workingmen to give up their jobs, singly or in a body, is not the question at stake. The right of men to speak and to walk the streets is not assailed. It is the right to combine for the unlawful purpose of injuring the business of another that is questioned. It is the right of men to conspire to coerce an employer into the adoption of a disastrous business policy and into the execution of unlawful agreements that is attacked. The unlawful nature of the combination has been shown in this case. It is pointed out that the primary object of the conspiracy was to injure the plaintiff's business; that this injury was to be inflicted for the purpose of compelling him to agree to discharge his own son who did not see fit to pay a fine to the union. The combination was in law an unlawful one. Without regard to the nature of those agreements, the conspiracy to injure the business of the appellee was unlawful; that the right to manage one's business in his own way without interference by unlawful combinations is fundamental in a free government.

"The enforcement of the law can never be hostile to the true interests of the workingman; and those men who teach and preach that in some mysterious way the assertion of the basic principles of our institutions is to be regarded as an oppression of the workingman are not the friends, but the worst enemies of labor. It is far better for employers and employes alike and for the peace and safety of the state that such relief injunction in strike cases be exercised by the courts where such parties can be heard than to permit such violations of law to go unrestrained until force is arrayed against force and the strong arm of the executive is compelled to intervene with troops to prevent disorder and the destruction of property.

"The proposition that a combination to inflict injury upon another wrongfully is unlawful goes back almost to the beginning of our system of laws. It will be a part of that system as long as freedom of contract and the liberty of the individual last. Such a combination of capital to restrain trade, establish monopoly and oppress the public is unlawful; such a combination of labor to inflict injury upon business and to deprive other men of the right to work is just as unlawful. Before the law all are equal; and men must learn that the rules which they invoke against others are equally binding upon themselves."

### NATIONAL METAL TRADES ASSOCIATION NOTES.

It has been decided to hold the annual meeting and convention of the N. M. T. A. at Philadelphia. The administrative council will meet on Monday and Tuesday, March 14 and 15, and the convention will be held on March 16 and 17. An interesting program is being prepared. Among the subjects for discussion are "The Restriction of Output," "Piece Work" and "Local Associations."

Commissioner DuBrul and Secretary Wuest, of the N. M. T. A., will leave for Indianapolis on Saturday, Jan. 2, for the purpose of organizing a metal trades association in that city. It is contemplated to have an employment bureau in connection with the new association.

Arthur E. Corbin, who has been the first district organizer of the N. M. T. A., has resigned to become secretary of the Connecticut Valley Metal Trades Association, which association will operate an employment bureau.

Advices have been received from F. A. Geier, treasurer of the N. M. T. A., of his safe arrival in Naples, Italy.

Chas. F. Waltz, of Marion, Ind., has been chosen secretary of the Cincinnati Employers' Association and will open his office at once in rooms 1125 and 1126 Union Trust building.

### LABOR NOTES.

Civil suit has been started at Elgin, Ill., by Mathew M. Trauton, an Aurora tinner and sheet metal worker, against the Aurora Tinners' Union for $5,000. Trauton was discharged from his position with an Aurora firm because he was not a union man, the men working with him threatening to strike. Since then he has not been able to secure work.

The Sharon Steel Hoop Co., Sharon, Pa., has announced a reduction in wages of 10 percent for men who are not governed by the Amalgamated Association. The company employs about 1,200 men.

Over 1,000 iron workers in Conshohocken, Pa., will be affected by an average reduction of 10 percent in wages to be made Jan. 1 at several iron mills of that city.

A truce has been arranged between the Inland Steel Co., of Indiana Harbor, Ind., and the Amalgamated Association. The workers are to accept the 10 percent reduction in wages until selling prices advance sufficiently to warrant the company in restoring the old schedule. The action of the company in refusing to deal with organized labor has been revoked. The Amalgamated Association is to be treated with and its members are not to be discriminated against.

Notices have been posted by the Colorado Fuel & Iron Co., Pueblo, Col., that when the works resume it will be at a reduction of 10 percent in wages.

On account of a refusal of skilled laborers of the New Haven Rolling Mill, New Haven, Conn., to accept a 10 percent reduction in wages, the company has closed for an indefinite period. About 400 men have been thrown out of employment.

Secretary J. G. Coleman of the Wisconsin Malleable Iron Co., Milwaukee, says that all the coremakers who quit recently have applied for their jobs; some of them several times. The company is only running half of the force now and does not consider that it has a strike on its hands.

The members of the International Association of Allied Metal Mechanics and the International Association of Machinists have decided to take a vote on the proposition to amalgamate the two organizations.

### Application for Receiver Denied.

Upon the application of William I. Schaffer, representing the Investment Co. of Philadelphia, Judge Johnson, at Media, Pa., Dec. 24, granted a rule to show cause why a receiver should not be appointed for the Tidewater Steel Co., of Chester. The Investment Co., in its petition, avers that the Tidewater Steel Co. is indebted to it in the sum of $270,000 and has other liabilities; that the plant is not in a position to meet the claims, and that it has been running at a loss for several months. A hearing on the ruling was held before Judge Johnson Dec. 26 and the application for a receiver was refused.

Isaac N. Solis, of Dick Brothers & Co., bankers, one of the largest stockholders of the Tidewater Steel Co., made this statement: "The Tidewater company does not owe the Investment company a dollar. The move is a mysterious one to me, and I cannot account for it. Our concern is solvent, in good financial standing and able to meet all its debts, which, summed up, would not be over $400,000, as against $2,500,000 assets."

The blooming mill of the Carnegie Steel Co., South Sharon, Pa., will resume operations about the middle of January. The wire and wire nail departments of the American Steel & Wire Co. at this plant will also resume about this time, and it is to provide steel for this purpose that the blooming mill will be started.

## PERSONAL.

M. A. Hanna & Co., Cleveland, announce that on Jan. 1, C. C. Bolton and Silas Hitchcock will retire from the firm and that Robt. L. Ireland will be admitted to membership. Mr. Bolton has been connected with the firm for twenty-five years, having entered its service soon after graduating from Harvard university. He is recognized as one of the ablest men in the pig iron trade in the Central West. Mr. Hitchcock has long been at the head of the vessel department of the firm and has managed it most successfully. Messrs. Bolton and Hitchcock will retire from business, at least for some time, and will take a well earned rest.

James T. Wakeman, general manager of the Eagle Foundry & Machine Co., Alliance, O., has been elected general manager of the Farmers' Mfg. Co. of that city. Mr. Wakeman will retain his present position for a time in addition to discharging the duties of the new one.

B. C. Watts, who has been supply agent for the Jeffersonville branch of the American Car & Foundry Co., went to St. Louis Dec. 26 to become assistant to W. E. Hedgecock, general purchasing agent for the company.

Seward Babbitt, who for a number of years has been general sales agent for the William Tod Co., Youngstown, O., has resigned to accept a position with the De La Vergne Refrigerating Machine Co., of New York City, where he will devote his time to the sale of the Koerting gas engine.

John Pengilly, for many years manager of the Chandler mine, Vermilion range, and since the retirement of D. H. Bacon, manager also of the Soudan hard ore mines, same range, has resigned. Capt. Pengilly's health has been poor for some time, and he has a beautiful home in Southern Minnesota to which he will now devote himself. He is an able mining man, an excellent manager both of men and properties. The captain has filled a number of public offices in St. Louis county, which has benefited much by his coolness, conservatism and common sense. It is probable that Manager Trezona, of the Pioneer mine, will become manager also of the Chandler.

Capt. Cundy, one of the old timers in the Lake Superior region, and for several years manager of the Cundy mine, Menominee range, first for the Illinois Steel Co. and then for the United States Steel Corporation, has resigned and will quit hard work and enjoy the rest of his life in quiet. The captain is a Cornishman, who came to this country when a boy, and but for a few years' service in the American navy during the rebellion, has been mining in copper and iron on Lake Superior ever since.

Harry Coulby has accepted the position of president and general manager of the Pittsburg Steamship Co. and will assume his new duties Jan. 1, severing his connection with Pickands, Mather & Co. and resigning the presidency of the Great Lakes Towing Co. The headquarters of the Steamship Co. will be in Cleveland, but the Duluth office will not be abandoned.

George W. Parsons, for many years superintendent of the frog, switch and signal department of the Pennsylvania Steel Works, will retire at the end of the year, and will be succeeded by Charles W. Reinoehl, the present sales agent of the company at Steelton.

David J. Evans has severed his connection with the Chicago office of the Lorain Steel Co. and has also resigned his position of secretary-treasurer of the North American Railway Construction Co. He has taken an office at No. 1564 Monadnock building, Chicago, where he will handle railway supplies, iron and steel. Mr. Evans has been connected with the Chicago office of the Lorain Steel Co. and its predecessor, the Johnson Co. since early in 1893, having had charge of the business for the past three years, during the sojourn in Colorado of A. S. Littlefield, Western sales agent.

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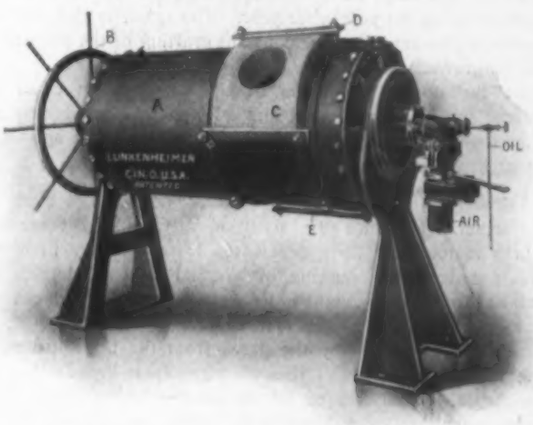
Edward A. Potter and Warren Nichol have been appointed receivers for the A. M. Crane Co., 26 West Randolph street, Chicago. It is understood that the business of the company will be continued by some of the present stockholders.

## THE LUNKENHEIMER METAL MELTING FURNACE.

This type of furnace was evolved after considerable experimenting with nearly every type of furnace on the market, and is the result of considerable study. The furnace consists of a cylindrical sheet-steel drum A, having cast-iron heads. The interior of the drum is lined with fire-proof tile, and there are two openings on opposite sides of the drum. Only one of these openings is in use, the other being closed by a fire clay filling. The object of having two openings is to increase the life of the linings of the furnace. It has been found that the furnace wears out quicker around the filling hole (which also serves as outlet for the flame) than elsewhere. The peculiarity of the Lunkenheimer metal melting furnace is that when one filling hole is worn out, this can be closed by a fire-clay filling and plate, the furnace reversed, and the other hole cut out and put in service.

The oil burner is of a special type, designed to give a large amount of heat with a minimum consumption of oil. In the Lunkenheimer foundry there are ten of these furnaces in use, and they are able to secure from six to seven heats per working day of ten hours from each furnace. The weight of each heat will average about five hundred and fifty pounds, and the oil consumption varies from two to two and one-half gallons of crude oil per hundred pounds of metal melted.




THE LUNKENHEIMER METAL MELTING FURNACE.

The life of the linings is from three to four hundred heats, this varying with the kind of metal melted. The whole furnace is of a heavy and substantial construction, and is found very durable. On account of the simple form of the tile it is very easy to re-line.

This furnace is made in two sizes, the No. 1 size having a capacity of five hundred and fifty pounds of metal per heat, and the No. 2 size having a capacity of twelve hundred pounds of metal per heat. The furnace is made by the Lunkenheimer Co., of Cincinnati.

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During the idleness of the Tod furnace of the Youngstown Steel Co., Youngstown, O., recently blown out, the stack is being remodeled. Chief among the improvements is a new top and the installation of a complete charging device, including new skip bridge with automatic charging buckets. Other changes embrace new blast piping and construction. The work is being done by the William B. Pollock Co., of Youngstown, O., blast furnace builders and erectors of steel plate construction.

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The Erie City Iron Works, Erie, Pa., incorporated with $1,000,000 capital, has qualified to do business in Ohio, with offices in Cleveland, where Hal H. Hill is the company's representative.

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John Z. Middleton has filed a petition of involuntary bankruptcy against the Clark Automatic Scales Co., 29 Broadway, N. Y., manufacturer of scales and machinery.

# The New Plant of the Lackawanna Steel Company, at South Buffalo.

*(With Supplement.)*

For more than four years the operations of the Lackawanna Steel Co., at West Seneca, or South Buffalo, N. Y., between four and five miles south of the city hall, Buffalo, have been followed with interest by steel works engineers throughout the country. The mammoth scale of the entire project naturally attracted attention to it in an unusual way. But this was but one of the features that made it stand out among all the important additions to our steel-making capacity built in the recent period of prosperity. The purchase of the site at Buffalo by the Lackawanna interests was noteworthy as marking the second removal of Pennsylvania rail manufacturers to the shores of Lake Erie, and called attention afresh to the economies of the Lake district for the assembling of steel-making materials. Another feature of interest was the fact that the company's engineers had the chance to develop from the ground up a scheme of construction involving a larger range and scale of operations in iron and steel in a single locality than has ever been carried out in one movement. Additions to original plant and the tearing out of old and substituting new have been the usual procedure in the development of American blast furnaces and steel works, and such work is going on year after year. The result is that the best known plants represent the constant grafting of the modern on the outgrown.

At Buffalo the engineers of the Lackawanna Steel Co. started with uncleared land and a clean sheet, and were not stinted in the outlay of money to command every species of economizing machinery.

### Noteworthy Departures.

Further reason for the attention attracted by these new works is found in their departures from ordinary procedure and practice. The digging of a canal that the largest ore vessels of the lakes might unload at the company's docks was unique. So, too, was the plan to install 40,000 h. p. of gas engines to be driven by the gases from the blast furnaces—the first introduction in this country, apart from some experimental operations, of an economy which German blast furnacemen have developed with highly satisfactory results. The use of electricity to the largest extent, the machinery for this purpose constituting one of the greatest installations known, and the building of an extensive retort coke plant on a modification of the Otto-Hoffman system, should also have prominence in any enumeration of what is characteristic of the new works. The ore handling problem, moreover, required special treatment; the rail mill, with its five powerful engines, represents the high point in rail mill construction and operation; and in the open-hearth department the original plans contemplated a large use of the comparatively new Talbot system, but for the present this has been laid aside and the furnaces under construction are of the stationary type.

### Physical Features.

The land occupied by the Lackawanna Steel Co. at West Seneca runs north and south for 3¾ miles measured on the Lake Erie shore line. About 1½ miles is taken up with the plant or with excavations for new work. The riparian rights and land under water contribute an area of 530.34 acres of the total of 1,442 acres in possession of the company—the equivalent of more than two square miles. The property in the first place was in part swamp land with low meadows and dunes. The surface consists of varying depths up to 15 feet of decayed vegetable matter at an average of three feet above the level of the lake. Under the swamp formation comes a body of red clay and under this a layer of blue clay. The clay is of unstable composition and quite soluble in water. Shale rock underlies the clay and changes irregularly to a limestone formation at varying depths. The bed rock is found deeply eroded by glacial action at from 10 to 70 feet deep. The low land required a timber cribbing extending from the Government breakwater at the southern extremity of the harbor of Buffalo along the water line of the property for several thousand feet, as shown on the ground plan. The timbering is 8 x 10 feet of round logs ballasted with stone and on the side adjacent to the lake sheathed with stout oak. Heavy timbering has been required for the foundations of the substantial equipment, as the rail mill engines, etc., as the natural formation was of treacherous character and pits and shafts required shoring to prevent the slipping in of the sides.

The engineering difficulties attending the conversion of the original site into a fit place for the carrying on of steel manufacture may be imagined. The foundation work has involved the expenditure of hundreds of thousands of dollars. Practically every building erected stands on piles and cement, the piling varying in depth from 30 to 70 feet to rock or hardpan. Up to Dec. 1, 1903, no less than 150,000 piles had been driven and the cement used in foundation work is expected to total fully half a million barrels when all the construction work planned is completed. Fully 300 acres of the site required to be cleared before excavation could proceed. In one strip of land, 250 by 4,000 feet, where the ore storage is located, 20,000 piles were driven.

The unstable character of the ground and the unusual expenditure necessary in laying secure foundations have given rise to exaggerated and for the most part baseless reports concerning the difficulties experienced, since the completion of the plant now in operation. It is true that a crack has appeared in the wall of the soaking pit building at the north end of the rail building. Investigation shows this to be due altogether to a slight lateral movement, the result of expansion. The use of tie rods is expected to cure the trouble entirely. The reports of settling are without foundation in fact, and the operation of the enormously heavy rail mill engines is accompanied by much less vibration than is noticed at plants whose foundations have never been questioned.

### Canal and Tunnel.

The plan view shows clearly the location of the plant and its relation to the excellent harbor facilities provided by the completion of the arm of the Government breakwater at the north end of the property. The plan for a ship canal, that should bring the largest lake freighters to the docks of the company—one of a number of bold proposals of the Lackawanna Steel Co. engineers—has been carried out with excellent success and with promise of economies that will be better appreciated as time goes on. The canal is to be 4,000 feet long, when completed; it is 200 feet wide and 21 feet deep, measuring from low water mark.

The tunnel, which is indicated on the accompanying plan, was built to carry pipes and wires between the coke ovens and the main portion of the plant, as the canal could not be bridged. The tunnel is also the channel of passenger travel, and will be more in vogue for this purpose when the canal reaches its full extent to the south, requiring a long detour to the south to get from the coke ovens to the main plant, if one does not go by tunnel. It is 400 feet long and 90 feet below the yard level. The shafts at either end were sunk to limestone and through this the tunnel was driven. It is 10 feet wide and 9 feet high. The lining is 8-inch brick work. Passenger elevators traverse the shafts.

### The Coal and Ore Handling Machinery.

The handling of the enormous quantity of ore and coal which comes both in vessels and cars and must be stored previous to use, was one of the important problems confronting the engineers. After due consideration of all the methods in operation at the present time, it was determined to use for ore the combined storage and bin system. The underlying scheme in the system divides the operations into three parts, viz.: unloading the ore from the boats directly on to the stock; reloading the ore from the stock piles into bins, and charging the ore from the bins into the furnaces. The requirements of each one of these operations necessitated machinery specially designed to meet the conditions imposed by the purchasers,

and these have been successfully met by the builders, the Wellman-Seaver-Morgan Co. of Cleveland.

The unloading of the vessels and piling the ore in stock is accomplished by means of five Hulett automatic unloaders; the reloading of the ore into the bins by three unloading bridges fitted with Hulett patent buckets, and the charging from the bin into the furnace by special larries and incline hoists. As far as possible, all of the machinery is operated electrically.

### The Hulett Unloaders.

These unloaders are mounted on concrete walls at the face of the dock. The principal dimensions are as follows:

Clear span between tracks upon which the unloaders travel along the dock is 72 feet 6 inches.

The length of the overhang of the cantilever from the center of the rear track on which the unloader travels to the end of the cantilever is 158 feet ¼ inch.

The height of the top of the girders from the tracks is 20 feet 6 inches.

The machines travel back and forth along the dock so as to be able to go from one hatch to another at any time desired. They consist essentially of a walking beam mounted on a trolley frame, which has a back and forth motion, at right angles to the canal, on a movable bridge or gantry. To the outer end of the walking beam is attached a vertical leg supporting a bucket having a capacity of 10 tons. In operation, the outer end of the walking beam comes close down to the trolley frame, and the trolley carriage runs forward until the bucket is over the hatch of the boat. The bucket is then lowered onto the ore in the boat, automatically filled, raised, and at the same time the trolley is returned to its original position on the dock, the bucket dumping its load through a hopper into a bucket car. This bucket car is then hauled across the girder and up the inclined cantilever under the control of a separate operator. The bucket is tripped automatically at any point desired on the cantilever, and the ore falls into the stock pile.

The operator, who controls all the motions of the machine except the moving along the dock from hatch to hatch, is located in the bucket leg, and goes down through the hatch with his bucket every trip. This enables him to watch very closely the operations of the bucket, and to work into the corners of the boat more successfully. To enable the bucket to reach all the ore in the boat, the leg on which the bucket is suspended is mounted on a rotating table at the top of the bucket leg, and the operator is enabled to rotate the bucket into any position desired, so that it extends when open lengthways of the boat, or crossways, or in any intermediate position desired. The bucket when wide open has a reach of 18 feet, but when so desired this reach can be extended 2 feet 6 inches farther, this movement being in a straight line, acting as a hoe to pull the ore out of the corners of the boat. The distance between hatches on modern boats, as a rule, does not exceed 24 feet, so that the bucket reaches from the center of one hatch more than half way to the center of the other. These machines have unloaded 95 per cent of the cargo of a modern boat, the minimum rate being 200 tons per hour per machine with a maximum rate of 600 tons. The power for closing the bucket is furnished by a large hydraulic cylinder mounted in the bucket leg with the bucket. For rotating the bucket in a circle a smaller double acting hydraulic cylinder is provided.

In case it is not desired to put the ore on to a stock pile, it may be loaded direct through the chutes at the front end of the machine into hopper cars, as there is a track provided under the machine for placing these cars. Only two operators are required for each machine. The capacity of the bucket and bucket car is ten gross tons per trip. On the corner of each machine is provided a small revolving derrick, which is operated by a separate motor. After the large bucket has reached all the ore that it can get at in the boat, the balance which is usually about 5 per cent of the cargo, is shoveled into small one-ton dumping tubs by hand. These tubs are then hoisted out and swung over the hopper by the derrick. In this way the entire cargo of the ship is unloaded without the necessity of its moving from its dock.

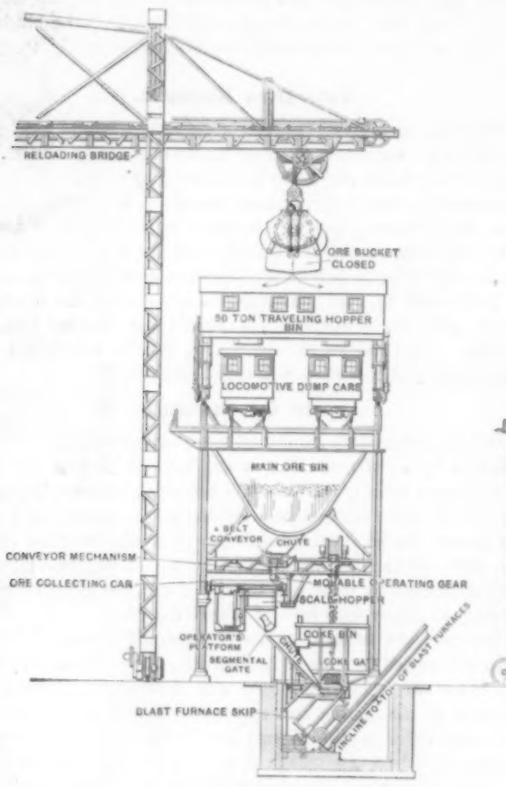



FIG. 3.—CROSS SECTION OF ORE BINS AND RELOADER.

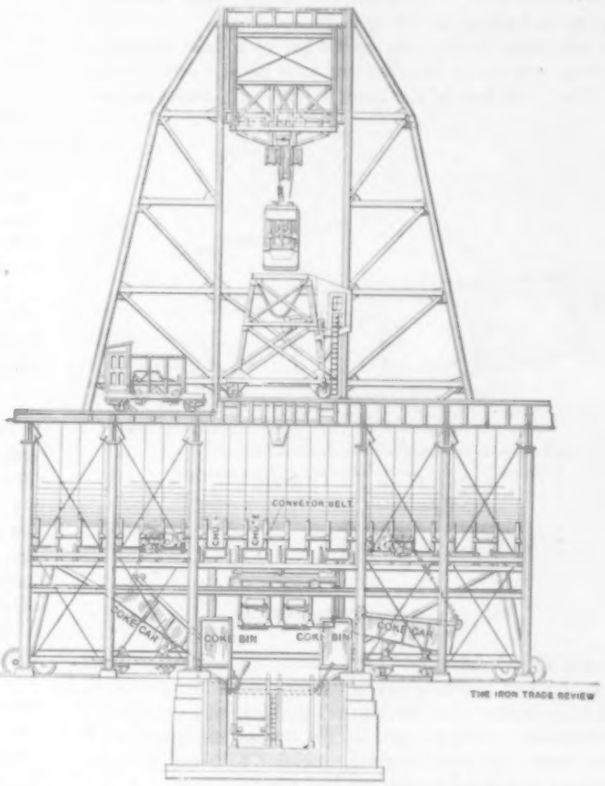



FIG. 4.—ELEVATION OF BINS AND RELOADER, PARALLEL TO DOCK.

### The Reloading Bridges.

These bridges have approximately the following dimensions:

Clear center span, center to center of towers, 293 feet 6 inches.

Cantilever extension over the dock, 48 feet.

Cantilever extension over the ore bins directly in front of the blast furnaces of 33 feet.

The height from the track of the bridges to the ground is approximately 85 feet.

The front or machinery tower of the bridge is run on the same track with the rear end of the unloader, these tracks being about 30 ft. gauge. The machinery for operation of the bridge is all located in the front tower and is electrically driven. The ore is lifted out of the stock pile by a 7½-ton Hulett self-filling excavating bucket, which, after filling itself, is hoisted and conveyed over the bins and bin filling cars into which it dumps. The speeds of action of the bucket are about as follows:

Hoisting speed .....200 ft. per minute
Traverse of trolley on bridge.....800 ft. per minute
Traverse of bridge along tracks.....50 to 75 ft. per minute

The brakes are so arranged that in case of any mishap to the electric power, they are applied by gravity, all machinery being instantly held. It is impossible to drop the load. The simplicity of the operating mechanism enables one operator to perform all operations of the bridge. On the bridge traverse mechanism is provided a safety brake so arranged that in order to move the bridge along the length of the ore pile, it is necessary for the operator to stand on a weighted platform, which releases the brake from the moving gear, and he remains standing on this platfrom until the bridge is moved to the desired position. Immediately on stepping off, the brake is automatically applied, so that it is impossible for a heavy gust of wind or accident to start the bridge, the brakes being powerful enough to skid all of the wheels.

The automatic buckets are somewhat of a new departure in handling iron ore at furnaces, and have proven very efficient tools. They will handle the hardest lump ore, limestone and

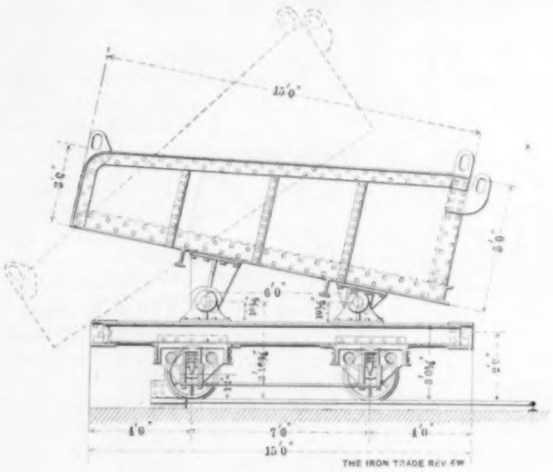



FIG. 5.—TILTING COKE PAN CAR.

other obstinate substances. They have an advantage over other methods of handling ore in winter time, when the ore is full of frost, in that their weight will go through 4 or 5 inches of frozen crust. After the pile is once opened up, it will work its way under the crust, making it easier to break it away. The bridges will easily handle 200 tons per hour each.

### Bin System.

Parallel to the line of blast furnaces on the side towards the lake is a bin system with a capacity to take care of ore and limestone for the production of 3,800 tons of pig iron per day. In the handling of coke, the feature of dumping it from railroad cars into stationary bins has been abandoned, and in order to save rehandling, the coke will be brought direct from the ovens to the furnaces in pans, holding about 6 tons of coke. These pans are mounted on cars and pivoted in such a manner that by hoisting the rear end of the pan, the coke slides out into a hopper, provided with a gate and thence is dumped into the furnace skip. By this method, the breakage of coke is reduced to a minimum, thus avoiding the accumulation of fine coke dust.

The bins are of the suspended parabolic type 26 feet on top and 16 feet deep, having a total capacity of 443,437 cu. ft. They are divided by vertical partitions into 25 ft. or 50 ft. lengths for the different kinds of ore and stone. The bins are connected by trestles between each pair of furnaces, the total length of bins and trestles being 2,500 feet. The steel structure from which the bins are suspended supports the tracks for a 50-ton traveling receiving bin and tracks for 10-ton dump cars. The ore which is picked up from the ore yard, by means of a 7½-ton grab bucket operated by the reloading bridges, is dumped into the traveling receiving bin or gantry, which in turn fills the dump cars running underneath. These cars of the hopper bottom shape are then run to any of the bins and the ore emptied. This system of operating is very flexible, assures a perfect service and avoids any stoppages of the reloading bridges.

The bins are provided on the bottom with very large openings and conveying gates, which in practice have proved to be very efficient, as the flow of ore can be controlled and cut off with great accuracy. The gates consist of two cast iron drums and an endless rubber belt. The drum shafts are supported by a cast iron frame provided with adjustable bearings. The outer drum shaft has a driving gear, which engages into a pinion located and pivoted on the scale larry frame. The gates therefore, can only be started by the operator of the larries. The scale larries consist of two hoppers, provided with suitable gates and are suspended from a structural frame and run on tracks supported by columns of the bin structure. They are electrically driven and each fitted up with five scale beams. Each hopper has a capacity of 75 cu. ft.

The bin system has been housed in by the building curtain walls. Coke-fired stoves placed at intervals heat the bin house so that in severe weather the ore discharges freely from the bins.

### Coke Oven Machinery.

The coke oven plant, not yet in operation, is laid out in two parallel rows each consisting of 12 batteries of 47 ovens. The space between the two rows is occupied by two tracks for the coal charging and coke pushing machines, four coal receiving bins, boiler houses and all necessary by-product plants. The coke receiving tracks are outside and parallel to the line of ovens. In order to handle the immense quantity of from 6,000 to 7,000 tons of coal per shift, which is required when the whole plant is in operation, a Hulett car dumper has been erected. This and all the machinery for the coke plant were furnished by the Wellman-Seaver-Morgan Co.

### The Car Dumper.

This is designed to handle all sized cars weighing with their contents up to 160,000 lbs., at the rate of 30 cars per hour. The dumper consists of a steel frame work supporting a cradle pivoted at two fixed points. By means of gearing and ropes the cradle can be revolved through an angle sufficient to give the sides of the car an inclination of 70 degrees from the horizontal, and by means of suitable chutes the contents can be discharged either into bins or transfer cars.

The cars are brought to the dumper by a special mule or push car moved by a rope haulage rig, driven by electric power. The car, when run onto the dumper, is automatically clamped to the cradle, and every provision is made to ensure safe and rapid work. There are 8 ropes for revolving the cradle, and these are attached to a system of equalizing bars so that all the ropes are uniformly strained. The cradle itself is balanced by means of counterweights. The necessary motive power is supplied by two heavy railway type motors; the main gears have rolled steel tires with teeth cut out of the solid, and the machinery is provided with brakes amply powerful to hold the suspended cradle when loaded with the heaviest car. The operator's house is sufficiently elevated to give the operator a commanding view of the entire machine. It requires but one man to control the placing of the cars on the dumper, discharging the contents and removing the empty cars. The car dumper was designed to handle pig iron and coke, as well as coal, but owing to a change in plans it is not likely that it will be used to handle pig iron. From the receiving hoppers, the coal will be elevated and conveyed into four bins, each of 1,500 tons capacity, by means of a system of 36-inch belt conveyors provided with automatic tripping devices over the bins. The total length of the belt conveying system is nearly 2,600 feet.

Running along on tracks parallel to the line of ovens are the combination coke pushing and coal charging machines, provided with a ram for pushing the coke from the ovens, and also carrying a box containing the compressed coal for charging the ovens. Underneath the coal bins there are located four parallel tracks for supporting these boxes, when they are run

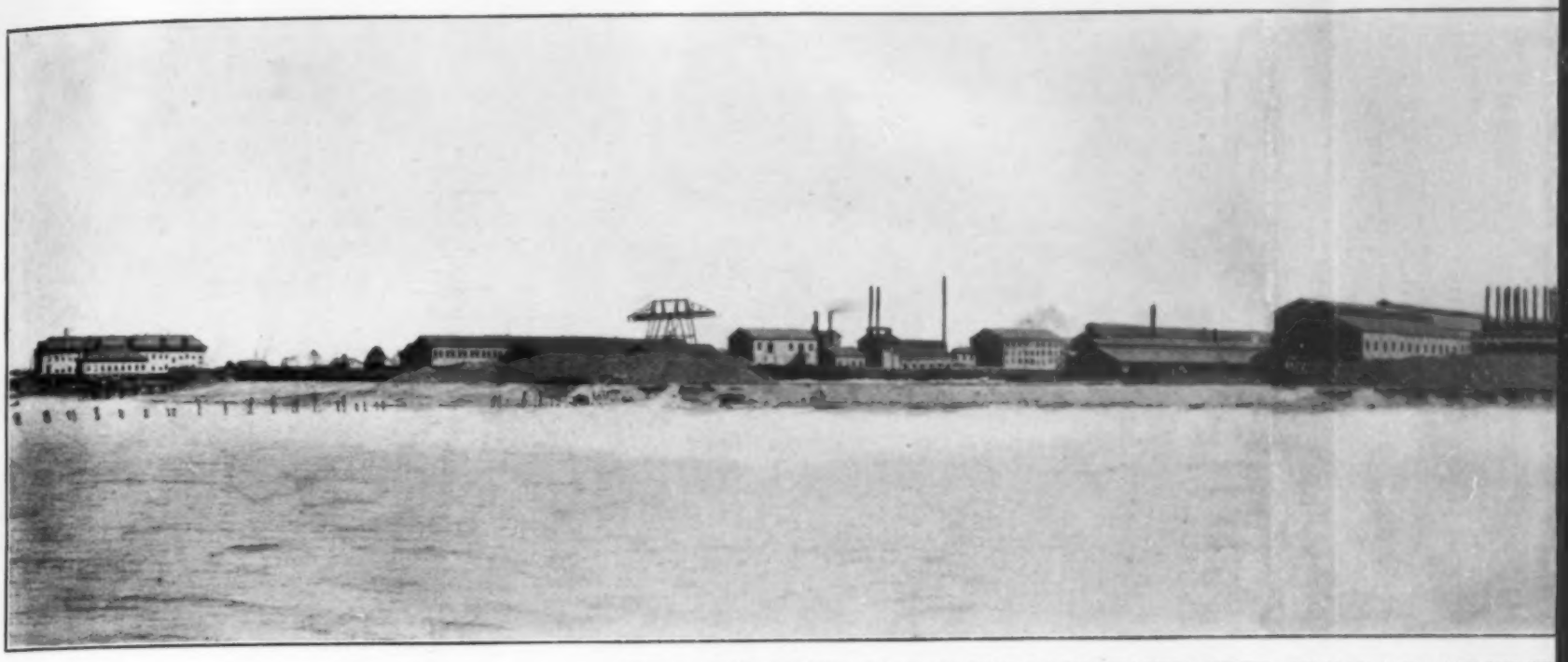
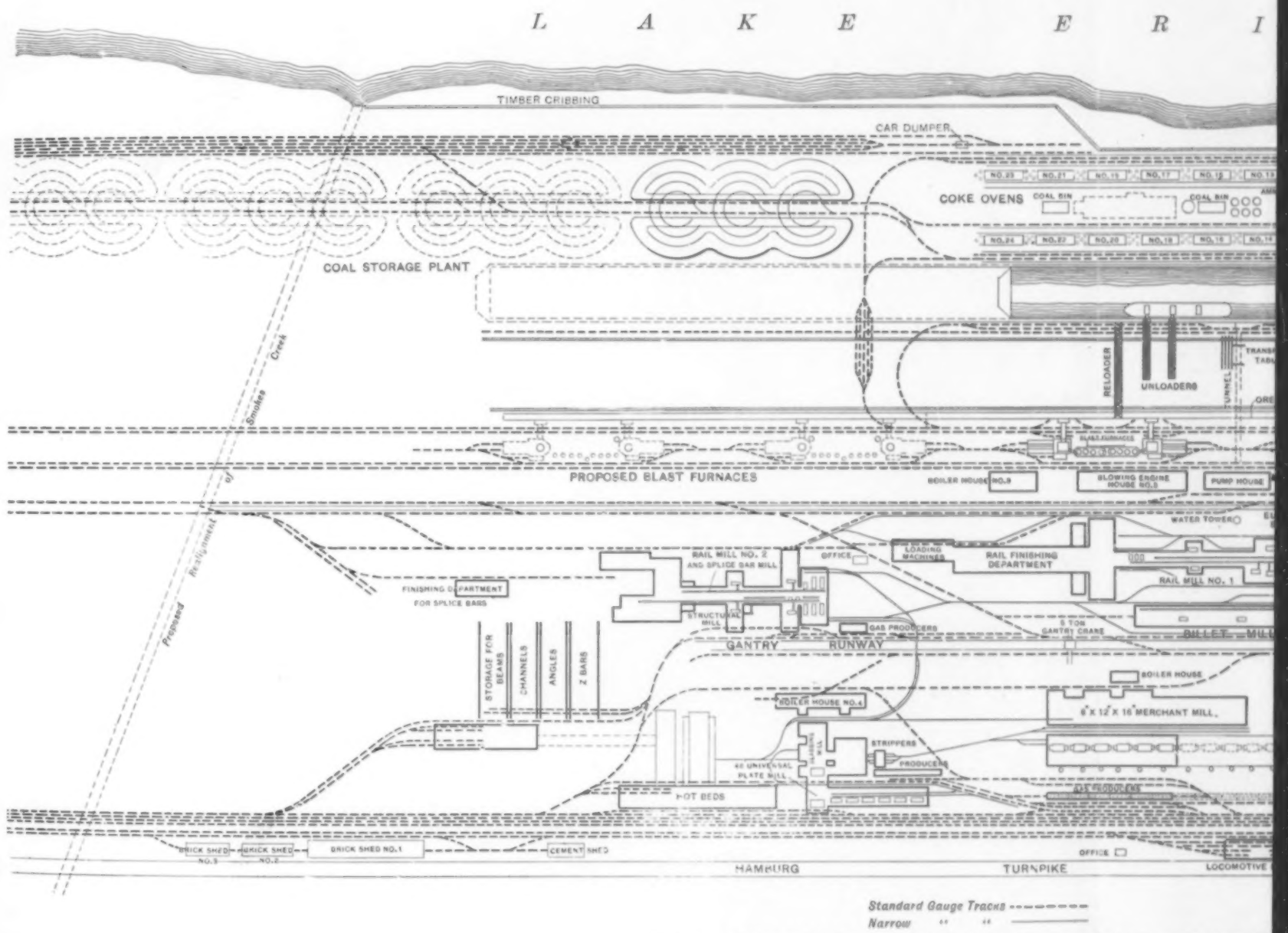


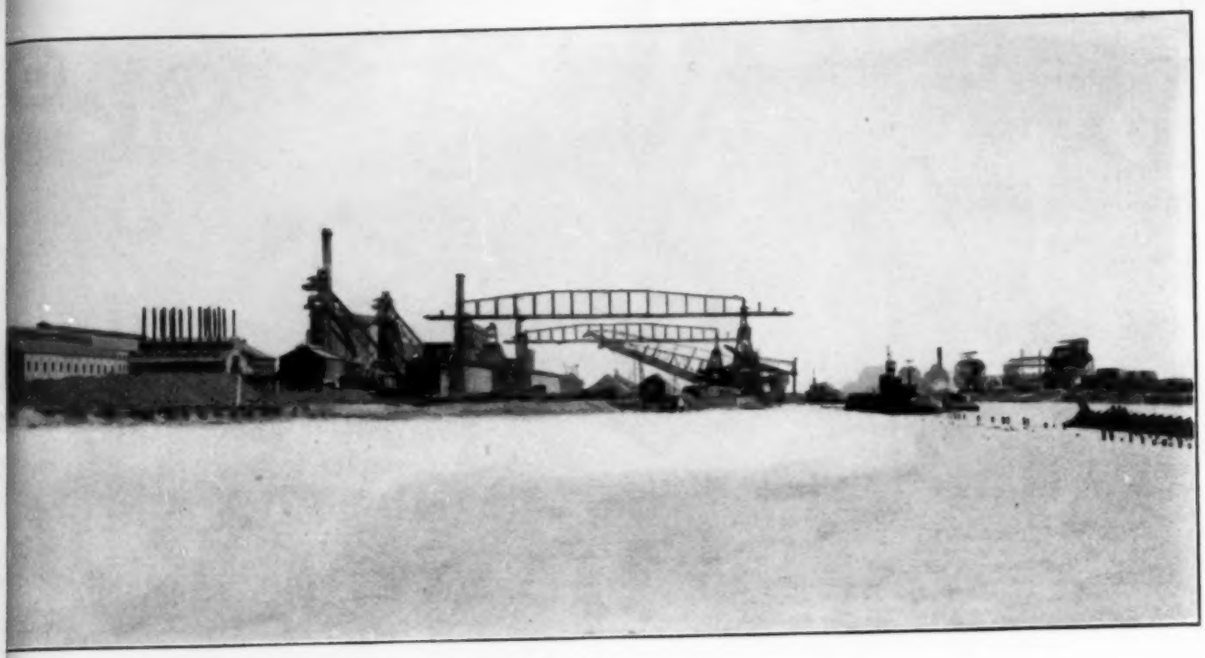
FIG. 1.—PANORAMIC VIEW OF THE LACKAWANNA STEEL CO.'S PLANT AT SOUTH



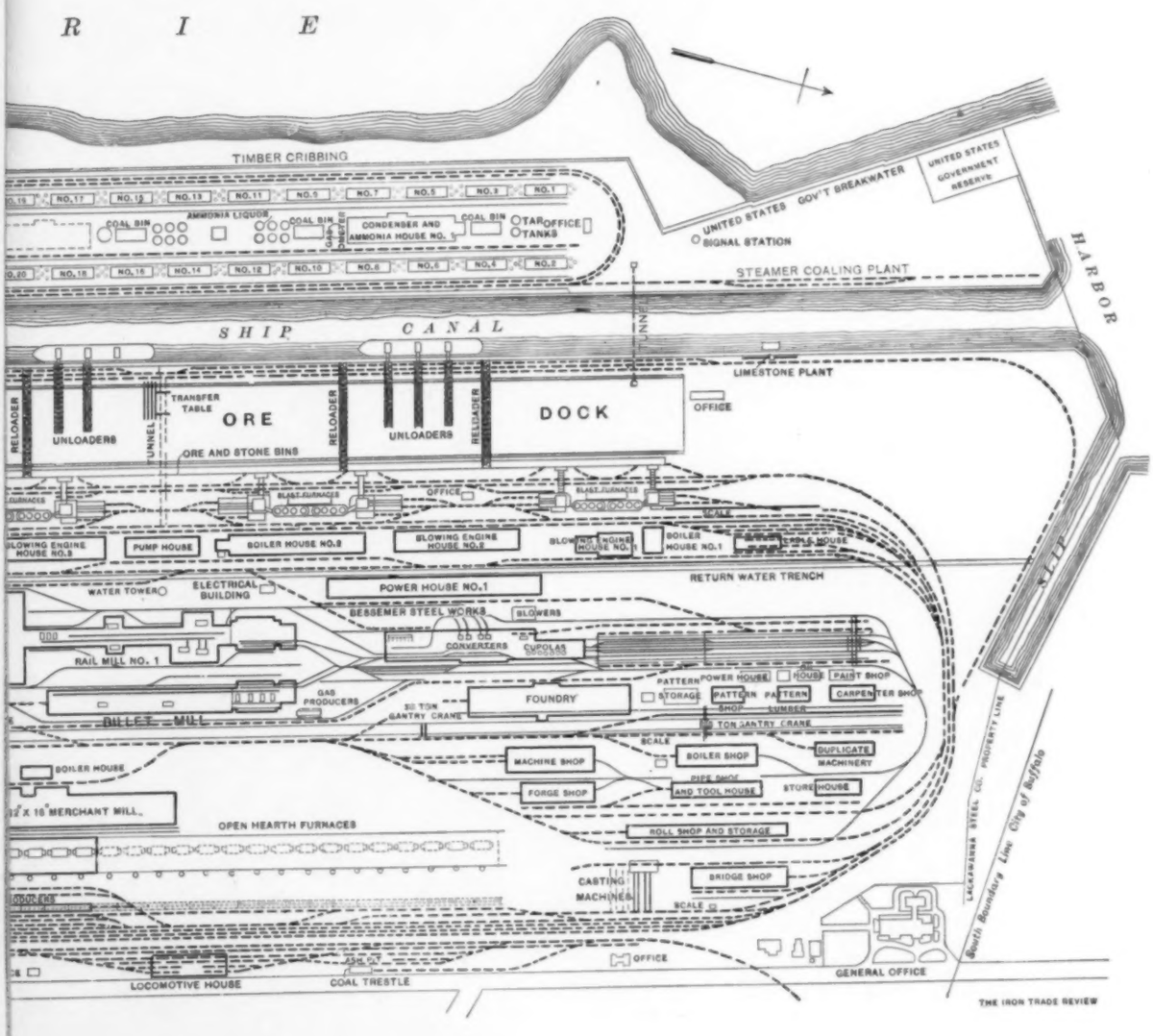

*Standard Gauge Tracks* ----------
*Narrow " "* ——————

FIG. 2.—PLAN OF THE LACKAWANNA STEEL CO.'S PLANT AT SO

SUPPLEMENT TO
THE IRON TRADE REVIEW
DECEMBER 31, 1903



PLANT AT SOUTH BUFFALO, N. Y. (Looking Southeast).




'S PLANT AT SOUTH BUFFALO, N. Y.

back under the chutes of the bin, to be filled with coal. Placed underneath each bin are eight ramming machines, two over each track, which compact the coal as it is chuted into the boxes. After a box is rammed, it is run out on to the combination machine, and carried to a position opposite the oven from which the coke is to be pushed. After the coke is pushed out, the charging box is brought opposite the same oven and the coal cake is charged into the oven. The coke is pushed from the ovens into large pans where it is quenched. The pan is then picked up bodily by a gantry crane and emptied into coke cars, standing on tracks between the gantry crane tracks.

FIG 6.—ORE PILE, BRIDGES AND CANAL. PART OF COKE PLANT AT LEFT.

### Coal Charging Boxes.

There are provided 20 coal charging boxes, each consisting of a base plate or peel, resting on rollers, having a rack attached thereto, and engaging with suitable pinions and gearing for moving the peel into the oven with a cake of compressed coal. The sides and ends of the box are of sufficient height to form a cake of coal. The front end or the end nearest the ovens, is formed of two doors with locking device connected directly to the operator's cab, by means of locking levers.

The rear end is stationary and is built up rigidly on the lower framework of the machine. The sides of the box are supported by short links, with pin joints, attached to side posts, which form part of the solid framework of the machine. To the lower corner of the rear end of each side plate is fastened a pin and roller, which engages with a cam on either side of the peel. After the box has been filled and rammed, it is placed on the pusher platform and moved to the oven. When the oven has been emptied and the coal box brought into position, the front door of the box is opened from the cab, and the peel set in motion. This starts the peel toward the oven, pushing forward on the sides, causing them to rotate about their several points of support, thus relieving the cake of coal from any side pressure. The coal is then placed in the oven on the peel, and the doors closed. The door on the end of the oven nearest the coal box is lowered down to the peel and the peel withdrawn, leaving the cake of compressed coal in the oven. The cams on the peel on their return engage with the pins on the rear end of the side plates, and draw them into their original position, locking them. The front doors are closed and the coal box returned to the ramming station for a fresh charge. The machine is mounted on heavy trucks which are driven by a 50-h. p. electric motor, which also operates the peel. By means of these trucks and motor, the box is run underneath the bin to receive its charge, or back onto the platform of the coke pusher. The box is held on the pusher platform by rail clamps, operated from the cab.

### Coke Pushers.

There are ten coke pushers, which will be operated as follows: The coke is pushed from the ovens by means of a heavy ram carrying a cast steel rack driven by a pinion and connected by means of suitable gearing to a 50-h. p. electric motor. This ram is guided by rollers, a sufficient number being used to hold it properly in place. On the framework of this machine are provided tracks for a coal charging box. The whole mechanism is carried upon massive steel framework resting upon four track wheels; these wheels being turned by means of a suitable gearing and clutches connected to the 50-h. p. motor used to operate the ram. Situated on this steel framework in a convenient position is the operator's cab, built

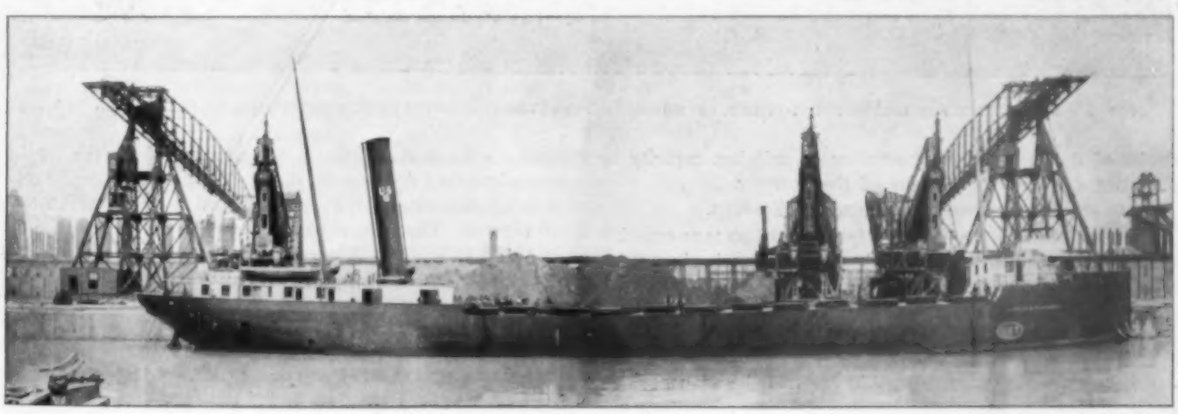


FIG. 7.—VIEW OF HULETT UNLOADING MACHINES.

up of steel framework and covered with corrugated galvanized iron, and also containing a sufficient number of windows to allow the operator full sight of all the operations of the machine. The operator's cab contains the controllers, etc., for all the operations of this machine throughout. The operation of the machine is as follows:

The pusher is run along the tracks parallel to the line of coke ovens, until the tracks on the pusher platform are directly opposite those from the coal bin. The coal charging box is run onto the pusher platfrom and clamped there by means of rail clamps on the coal box. The whole machine is then moved to position in front of the oven to be drawn. The clutch connecting the motor with the pinion driving the ram is engaged and the coke pushed out of the ovens. The coal charging box is then placed in front of the oven as described above.

### Compacting Machines.

Under each bin there are located eight coal ramming machines, consisting of hammers working in steel guides and actuated by means of an electric motor. The rammers are supported upon the framework of the coal bin, in which a sufficient allowance is made for the strain due to same. The rammers can be operated in any desired height without changing the stroke of the machine. A controller of sufficient capacity is placed at a convenient position of the operator.

### Coke Loading Gantries and Coke Pans.

There will be provided ten gantry cranes of 20 tons capacity for handling the coke pans. Each pan is of ample size to receive a full charge from one oven, and they are of strong and rigid design, bottom and sides being lined with cast iron plates. The coke, after being discharged into the pans, is quenched and then dumped into receiving cars by means of the gantries, which travel on a track in front of the ovens. Each crane is provided with two independent hoists of 10 tons capacity each, fitted with independent electrical and mechanical brakes. The pans are emptied by running one hoist ahead of the other, thus tilting the pan, and allowing the coke to run out.

The crane throughout is of special design, constructed to withstand the most severe usage. All parts are easily accessible for repairs or inspection, and all exposed running parts are protected from the weather. The operator is conveniently located in the most advantageous position for operating the crane. The travel of the crane on the tracks is controlled by a powerful foot brake.

Of the 24 batteries of coke ovens referred to above only 20 batteries, or 940 ovens, will be built at present. Four batteries are practically completed now. Six more are rapidly being completed, and it is expected that retort coke will be made in May or June. The four batteries now nearly finished are Otto-Hoffman ovens. The remaining ovens will be built of the Rothberg type.

### Blast Furnaces.

The line of blast furnaces is just to the east of the ore docks and bin system, and at present consists of two furnaces in operation and four under construction. Furnaces 1 and 2, which are in operation, and each producing from 260 to 285 tons of Bessemer iron in 24 hours, are in part a reconstruction of furnaces dismantled at Scranton and are blown by engines in blowing engine house No. 1, which were in service at Scranton. Both furnaces are 86 feet high, with diameter of 17 feet at the bosh and 11 feet at the hearth. The diameter at the stock line is 12 feet and the distance from the stock line to the top of the furnace is 9½ feet. The top construction is the now rather familiar one of furnaces using any considerable percentage of Mesabi ores, employing the double bell and hopper, with automatic filling by means of two skips in balance. The hoisting bridge rises at an angle of 50 degrees. Seven explosion doors are provided, of 3 feet 7 inches diameter each, their combined area being about half that of the top zone of the furnace. Gases are taken off from the top in a three-branched downcomer, the three flues uniting at the top of a large dust-catcher. Furnaces 1 and 2 are blown through 16 tuyeres. The total volume of each furnace (Nos. 1 and 2) is 12,582 cubic feet. There are four stoves to each; these are 18 feet diameter and 85 feet high for Nos. 1 and 2 furnaces and 22 feet diameter and 135 feet high for the four uncompleted furnaces. The smokestack for the Nos. 1 and 2 groups of stoves is 10 feet 6 inches in diameter and 175 feet high; the two stacks for the other stoves are each 205 feet high from top of foundation. The stoves are of the central combustion type, designed by the Lackawanna Steel Co. They are equipped with spectacle hot blast and chimney valves of the Hartman type.

FIG. 8.—EXCAVATION FOR ENGINE FOUNDATIONS, OPEN-HEARTH DEPARTMENT, ILLUSTRATING DIFFICULTIES OF FOUNDATION WORK.

Experience with Furnaces 1 and 2 has been quite satisfactory as to the efficiency of the filling and distributing apparatus. The operation of the cylinders for lowering the bells is controlled by the hoist house engineer, and the cylinders are actuated by compressed air. The hoist house drums are driven by a 90-h. p. General Electric motor. A system devised by the Union Switch & Signal Co., and electrically operated (as described in *The Iron Trade Review* of July 9, 1903), indicates to the operator the positions of the bells, and by means of push

buttons alongside the indicating apparatus raises or lowers the bells. The system is strictly interlocking and one bell cannot be lowered until the other is in place. The scheme for the sequence of skip loads of the various materials, as devised by the company's blast furnace superintendent, has contributed to even distribution of stock and regularity of working. The skip holds a ton of coke or 7,000 pounds of ore. A charge consists of nine skip loads in the following order: 3 skips of coke, 2 of ore, 2 of coke, 1 of ore and 1 of limestone. This gives an odd skip, rotates the charge and properly distributes the stock.

Furnaces 3, 4, 5 and 6 are 94 feet high, with diameter of 24 feet at the bosh and 17 feet at the hearth, this being a reduction from the height originally proposed, which was 110 feet. As it is well established that large output is not a function of height, beyond certain limits, and is chiefly dependent upon volume of air, the large outputs aimed at in the outset are still figured upon—800 tons in 24 hours for each of the four larger furnaces. This calculation is based on the performance of Furnaces 1 and 2, in which the volume of blast is from 23,000 to 28,000 cubic feet per minute. Four 2,000-h. p. Körting gas engines will furnish blast for each of the large furnaces (three of the four engines being operated at one time). Each engine furnishes 24,000 to 25,000 cubic feet of free air per minute, so that each furnace will receive about 75,000 cubic feet of air per minute. These engines will be driven at 80 revolutions per minute. There is one air tub to each, 76 inches diameter and 60 inches stroke.

The gas washing equipment at the blast furnaces is naturally an important adjunct, in view of the use of the gas in engine cylinders. When it is stated that the two furnaces now in operation give off gas enough for their eight stoves, and for the boilers which furnish steam to the 6,000-h. p. Fritz blowing engines, and in addition supply all the gas for the 8,000 h. p. of Körting engines in the power house, the power economies secured by the departure made at Buffalo begin to be appreciated. From the dust-catcher the gas is taken off in a 36-inch horizontal main entering the top of which at intervals are 14 one-inch nozzles. These are connected to a water supply and have individual valves for spraying the gases on their way to the horizontal settling chamber shown just beyond the dust-catcher in Fig. 12. There is a water-tight car underneath this reservoir and a convenient valve allows the sediment to be dumped from time to time into the car. A water seal is provided in the settling chamber, from the top of which the gas is taken off by another 36-inch pipe and conveyed to any two of four centrifugal washers. Another series of nozzles is inserted in this pipe between the settling chamber and the fans for further washing. The gases before entering the tightly enclosed fan chamber pass through a large down-take whose size facilitates further deposition of dust. In the fan chamber the last remaining suspended matter is separated from the gas and the latter is cooled to 80 degrees Fahr. before entering the main leading to the power house. Water for the gas-washing plant is the bosh-water from the blast furnaces.

It is found that any unusual admission of moisture into the furnace is promptly felt in the power house. The hydrogen generated gives a richer gas and the increased calorific power is apt to cause racing of the engines. Nothing serious in this direction has developed thus far, however. While there is some variation in the gas delivered to the engines the following analyses are typical. The calorific power is from 85 to 95 B. T. U. per cubic foot, and the production of gas is reckoned at 115,000 to 150,000 cubic feet per ton of pig iron produced:

| | Percent by volume. | Percent by weight. |
|---|---|---|
| CO | 24 | 24 |
| $CO_2$ | 12 | 17 |
| N | 60 | 58 |
| H | 2 | 0.2 |
| $CH_4$ | 2 | 0.8 |
| | 100 | 100 |

At present all the iron from the blast furnaces is taken by ladle cars to two Heyl & Patterson pig casting machines. The mixer will probably be in readiness by February. Eventually the pig casting machines will be used for Sunday metal or in case of a shut-down of the converter plant. An additional pig casting machine is about to be installed.

FIG. 9.—PILING FOR PIT FURNACES AND BLOOMING MILL, OPEN-HEARTH PLANT.

### Bessemer Steel Works.

The Bessemer steel works and the rail mill, being the portions of the steel plant now in complete operation, may be described with some detail. In the parallel arrangement of the different longitudinal lines of plant, the boiler and blowing engine houses and the power house stretch out in line between the blast furnace and the Bessemer works, the distance being 495 feet from the center line of the blast furnaces to the center line of the cupola house. The foundation of the Bessemer works is first piles, on which is a timber grillage and above this, concrete piers. The average length of the piles driven here is 44½ feet. The Bessemer buildings are of structural steel frame, with brick curtain walls and iron roof tiled. The cupola house is 255 feet long, 60 feet wide and 66 feet high to the under side of roof chords. The vessel floor is 13 feet 6 inches above the general yard level; the tapping floor 11 feet above the vessel floor, and the charging floor 30 feet above the tapping floor. There are eight iron cupolas, of 9 feet shell diameter and 30 feet high, with 10 tons capacity per hour, and four spiegel cupolas 30 feet high and 7 feet shell diameter. There are four hoists of 10 tons capacity each, two Crane Elevator Co. engines, 14 x 16 inches, on the tap-

ping floor operating two cages each. On the vessel floor are three Fairbanks iron scales of 40 tons capacity each, two spiegel scales of 20 tons and one scrap scale at the hoist, of 10 tons capacity. On the same floor are three iron ladle cars of 12 tons capacity each, two spiegel cars of one ton capacity each, and three Westinghouse 10-ton electric locomotives. The track is 3-feet gauge. On the charging floor is an electric charging machine of Lackawanna Steel Co. design, on a track of 10-feet gauge, two transfer machines and two transfer cars and motors.

At the mixer house, which is next in order, the Bessemer steel works building widens to 97 feet 6 inches, the mixer house being 37 feet 6 inches wide and 75 feet long. The height of the mixer house floor and motor floor is 19 feet above the general level and the mixer platform is 9 feet 8½ inches above the mixer house floor. The mixer building is commanded by a Morgan Engineering Co. electric traveling crane of 40 tons capacity. The mixer, which is of 300 tons capacity, is not yet in use but will be when Furnaces 3 and 4 are blown in. Its dimensions are: Length of shell, 25 feet 6 inches; width of shell, 18 feet 3 inches; depth of shell, 13 feet 5½ inches. The lining is 18 inches thick, with the exception of the roof which is 12 inches. Oil will be used for heating the metal.

The converter house is 237 feet 6 inches long and 97 feet 6 inches wide. The height is 70½ feet to the under side of the chords. There are four converters, each of 26,000 pounds maximum capacity, arranged in pairs, the distance between Nos. 1 and 2 and between Nos. 3 and 4 being 19 feet, while Nos. 2 and 3 are 43½ feet apart. The outside diameter of the converter shells is 9 feet 6 inches and height 15 feet. The lining is 11¼ inches thick, decreasing at the mouth to 6 inches. They are blown through 30 tuyeres of 19 holes each, of 5-16-inch diameter. The actuating mechanism is a rack driven by hydraulic pressure cylinders of 20 inches diameter and 14 feet stroke, these being operated from a pulpit on the side of the building opposite the converters. Two bottom cars are provided, the adjustment of bottoms being by means of hydraulic pressure of 450 pounds exerted by a plunger of 16 inches diameter. Bottom cranes are of Lackawanna Steel Co. design, hand-operated. The pouring crane in the converter building is of 40 tons capacity, furnished by the Morgan Engineering Co. There are two electrical traveling ladle cranes, of 15 tons capacity each, also two hydraulic ladle cranes of 40 tons capacity each, handling ladles of 12 tons capacity. The radius commanded is 17 feet 7½ inches and the lift is 9 feet 6 inches. A manganese furnace on the vessel floor of the converter building is 13 feet 6 inches in length, 3 feet 9 inches wide and 4 feet 6 inches high, with a capacity of 800 pounds per hour of hot manganese. It is heated by coal or gas. On the same floor is the stopper oven 10 x 14 feet with a capacity of 60 stoppers. Four hydraulic car pushers in the converter building have cylinders of 8 inches diameter and a stroke of 11 feet 4 inches. Equipment for the bottom house consists of two electrically driven stone crushers and two electric clay mills. There are six bottom ovens, 22 feet in length by 12 feet 6 inches. Each oven holds two bottoms and heating is by gas or coal. The Bessemer works are well equipped with Westinghouse motors, 220-volt direct current, those on the mixer and pouring cranes being of 100 h. p. for the main hoist. The mixer motor is of 50 h. p. On the vessel floor are three electric locomotives of 40 h. p. each.

## Rail Mill No. 1.

More than one-third mile in length—or in exact measurement, 1,766 feet 6 inches—equipped with five of the most powerful engines employed in rolling mill service anywhere, and with its processes automatic to the last degree, rail mill No. 1 is justly regarded with pride by the engineers of the company. The foundation work was unusual in extent and massiveness, in view of the heavy service to which engines and rolls are subjected. Piles were driven varying from 30 to 50 feet in length, and spaced 4 feet 2 inches by 4 feet 6 inches; on top of these, 3 feet of concrete material. Under the pit furnaces a wooden grillage was used on top of the piles before concrete was added. The rail mill building includes in order the stripper house, pit furnaces, mills, hot beds, finishing department, cold saw house and loading house, and as an adjunct a group of gas producers, half of which serve the rail mill pit furnaces, while the other half will supply the billet mill yet to be erected. The stripper house is 50 by 74 feet, and the ingot cars enter at the north end. There are two hydraulic strippers, each with two plungers, to operate on four molds at a time. Two hydraulic car pushers adjust the ingot molds under the strippers. In the pit furnace building, which is 162 feet 6 inches long and 60 feet wide, are 16 soaking pits with rolling covers, actuated by hydraulic power, and fired by four gas furnaces of the Smythe type. The valves are located in a lean-to on the west side of the building. Over the soaking pits are two 7½-ton Morgan Engineering Co. electric charging cranes. An electric locomotive with buggy transfers the ingots from alongside the furnaces to the rollers leading to blooming mill No. 1.

The mill building proper is 702 feet long and 60 feet wide in addition to the east and west dimensions of lean-to and transept wings in which the engines are located. The lean-to

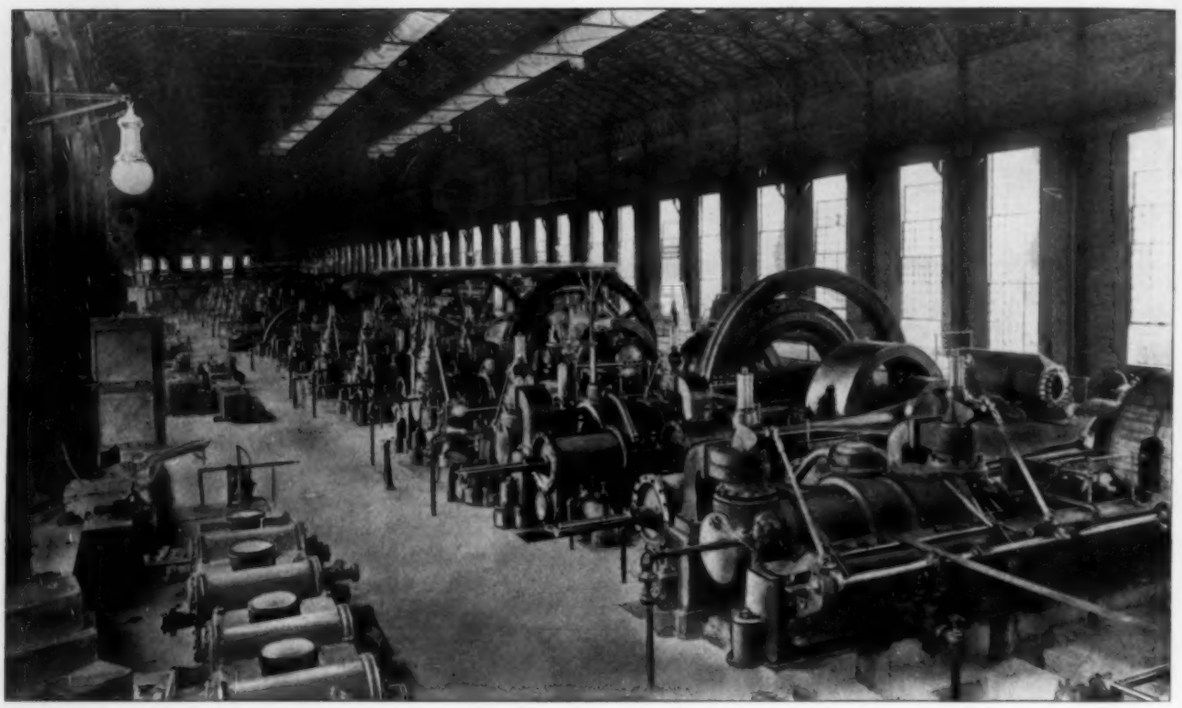


FIG. 10.—1000-H. P. KOERTING GAS ENGINES DIRECT CONNECTED TO GENERATORS IN POWER HOUSE NO. 1.

on the east side of the mills is for the blooming engines and is 162 feet 6 inches long by 65 feet wide; that on the west side for the roughing engine is 100 feet long by 50 feet wide. In the transept in which are located the finishing engines and rolls the west wing is 60 feet by 37½ feet and the east wing 60 feet by 65 feet. The crane equipment of the mill building consists of the following: One Morgan Engineering Co. electric traveling crane of 30 tons capacity, one Pawling & Harnischfeger crane of 25 tons capacity in the main building, one Whiting 60-ton crane in the east lean-to and a similar crane in the west lean-to, and in the finishing mill transept a Morgan Engineering Co. crane.

All the mills are two-high. The progress of the steel through the mill from the ingot to the finished rail is as follows: From blooming mill No. 1 and blooming mill No. 2, on each of which there is one pass, the ingot goes to blooming mill No. 3, in line with Nos. 1 and 2, where it is given four passes, the roller table distance between Nos. 1 and 2 being 90 feet 1½ inches and between 2 and 3, 40 feet 9½ inches. A hydraulically manipulated transfer carries the piece to the roughing rolls, which like the blooming rolls are 32 inches diameter. One end of the bloom is sheared before the first roughing pass, by a Mackintosh-Hemphill hydraulic shear located 70 feet north of the catcher's side of the roughing train. The other end of the bloom is sheared after the third of the four roughing passes, by a Morgan Engineering Co. steam crane, located 88 feet south of the roughing train. There have thus been 10 passes in blooming and roughing. The roller tables then convey the bloom to the finishing rolls where four passes are given on No. 1 and one final pass on No. 2. These rolls are also 32 inches in diameter. The distance to the first hot saw from finishing rolls No. 2 is 212 feet ¼ inch and between the three hot saws 20 feet respectively. The saws are electrically driven. Electricity (direct current) is also used throughout the mill in driving the roller tables.

From the hot saws the rails are taken by automatic rollers to the hot beds, across which they are moved by buggies fastened to wire rope and thence pass to the finishing department for straightening and drilling. There are 11 straightening presses of the Dickson type, electrically driven, and 22 drill presses of the Sellers type. The three roller lines in the finishing department are each 512 feet in length, leading to the cold saw house. The latter is equipped with two cold saws electrically driven. The loading house is last in line. Inspection is made in the finishing department and is followed by loading with an electrically operated loading machine.

The processes of the rail mill move forward with such speed that four or five bars or ingots are on the tables at one time in various stages. Before sawing the rails reach lengths varying from 120 to 180 feet, according to section. Thus a 4,700-pound 18½-inch ingot, which becomes a rail in 15 passes, is finally sawed into four lengths of 30 feet each, for 100-pound rails and into five lengths of 33 feet each for 80-pound rails. The capacity of rail mill No. 1 is expected to reach without difficulty 10,000 to 12,000 tons per week.

### *Rail Mill Engines*

The five great engines in the rail mill, which may be operated at a maximum speed of 150 revolutions per minute, call for more than passing notice. No. 1 blooming mill engine, which drives the first two pairs of blooming rolls, is a horizontal double-cylinder geared reversing engine built by Davy Bros., of Sheffield, Eng. The cylinders are 40 x 60 inches; piston rods, 6¼ inches diameter; crosshead pin, 6⅞ x 8 9-16 inches; crank pin, 9 x 10 9-16 inches; crank shaft journals, 18 x 24⅜ inches; jack shaft journals, 20 x 24 inches. The gears are steel castings, with straight cast teeth, and are 23¼ inches face. The pinion is 58.72 inches diameter with 22 teeth; the wheel, 114.78 inches diameter, with 43 teeth, the latter having 8.38-inch pitch. Diameter of steam line, 14 inches.

The second blooming mill engine which drives the reversing rolls, or blooming mill No. 3, and the roughing engine are of the same size. They are horizontal, double-cylinder geared reversing engines built by the Lackawanna Steel Co., and the cylinders are 41 x 60 inches. The piston rods are hollow forged and are 13 inches outside diameter; the crosshead pin 12 x 12 inches; crank pin, 17 x 17 inches. Crank shaft journals are 27½ x 48 inches; jack shaft journals, 29 x 48 inches. The gears are cast steel with double pelical teeth and 38-inch face. The pinion is 78.62 inches in diameter, with 26 teeth, and the wheel, 154.29 inches diameter with 51 teeth of 9½-inch pitch. The steam line is 20 inches in diameter. The horizontal reversing shaft is turned by a steam cylinder and an oil dashpot is attached to the steam piston. The Stephenson link is coupled to the reversing shaft by rods, one to the block and the other to the link. The rods are pivoted to the ends of a bar on the reversing shaft. Of the two finishing mill engines one was built by Davy Bros., of Sheffield, and the other by the Southwark Foundry & Machine Co., of Philadelphia. Both are horizontal double cylinder reversing engines, direct connected to the roll trains. Cylinders in both are 48 inches diameter by 54 inches stroke. Piston rods, 7¼ inches and 9½ inches diameter respectively; crank pins, 18 x 13½ and 24 x 14 inches; the four shaft journals, 18 x 18¾ inches and 24 x 30 inches. Steam lines are 18 inches.

### *Reversing Gear of the 40 x 60 Engines.*

The reversing gear furnished the Lackawanna Steel Co. for the 40 x 60-inch engines of its design was made by the William Tod Co., of Youngstown, O. The William

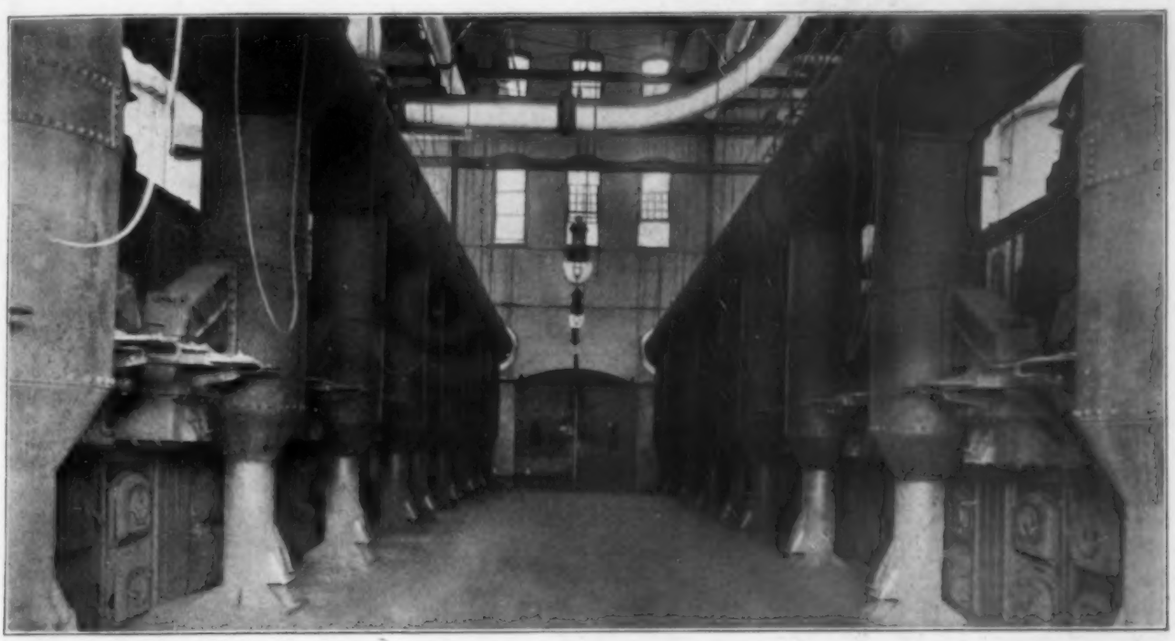


FIG. 11.—GAS-FIRED FURNACES IN BOILER HOUSE NO. 1.

Tod Co. supplied the throttle valves also, as well as the beds and cylinders of the 40 x 60-inch geared engines. The reversing gear, as in Fig. 16, is the floating device as applied to standard rolling mill engines and as employed by the Lackawanna Steel Co. has a double connection to the reversing shaft so that the block and the link are moved simultaneously in opposite directions; essentially, however, the arrangement as shown is typical of either the standard rolling mill engine of the Youngstown company or the special machine designed by the steel company.

The steam reversing gear has been used by the William Tod Co. in rolling mill engines, as it has been found more satisfactory than the common hydraulic gears, as the latter often give trouble which is particularly due to the rapid wearing of ports and valves. In a gear operated by steam or other elastic fluid the position of the piston is not fixed unless it is attached to a positive motion, such as a crank, or is controlled by a piston moving in an incompressible liquid, as oil or glycerine.

The accompanying reproduction from blue print shows in elevation very clearly the arrangement adopted by the William Tod Co. in the gear design for controlling the position of the piston in the steam cylinder and making its stroke proportional to the movement of the hand lever. It will be seen that A is a steam cylinder and B an oil cylinder; steam piston L and oil piston M are connected to a common piston rod. The operation of the gear will be followed most easily if we imagine same to be handled by the operator. The handle H is connected to the pulpit from which the operator controls all movement of the engine. Suppose handle H to be moved up slightly in the direction of the arrow; as the handle H is connected rigidly to lever P, valves C and D will be moved to the right, because point E serves as a fulcrum. It will be seen that point E is connected by a rod to lever F, which in turn is connected by links O and crosshead N to the pistons L and M.

As soon as the valves are moved to the right, steam will be admitted to the cylinder A on the right side of the piston as indicated by the arrow; and steam on the other side of the piston will exhaust through the hollow valve into the pipe marked "Exhaust;" at the same time the ports of the oil cylinder have opened sufficiently to allow oil to flow around from one side of the cylinder to the other; consequently both pistons move to the left, thereby pushing crosshead M and lever F to the left and raising lever A and links K, which raises the main valve gear and thereby changes the cut-off in the engine. As soon as this motion of the main parts to the left commences, rod R which connects floating lever S to the lever F is moved to the left and as lever H is now held in a certain fixed position by the operator, point T serves as a fulcrum so that valves C and D are returned to their central position, consequently both steam and oil ports are closed, and the motion of the pistons L and M, link O, and levers F and K is stopped. Steam will not be admitted again until operator moves lever H, and it is thus seen that link V which controls the direction of rotation and the cut-off of the engine will follow directly the motions of lever H; or in other words the motions of the hand of the operator. The resistance to motion (or work to be done by the operator) is very small, since he has to move only the small valves C and D.

From the elevation it looks as if there was some impossible core work to be done in the reversing and oil

FIG. 12.—BLAST FURNACES NO. 1 AND 2, LOOKING SOUTH. GAS WASHING PLANT IN MIDDLE GROUND.

cylinders, but this will be clear from the fact that the valve chest is off to one side and that, therefore, thicknesses in the elevation appear very much distorted.

The resistance which the main valves and links V offer depends largely on the condition of the surfaces; whether they are dry or well lubricated. Steam cylinder A must, of course, be powerful enough to move the valves in their very worst condition, and will, therefore, be too powerful for good working conditions; consequently if no provisions for regulation were made the motions of the pistons L and M would be too quick and cause a slamming action. To avoid this, plugs 1, 2, 3 and 4 have been provided, by means of which the area of the ports can be narrowed down to any desired amount and any desired smoothness of operation be obtained. In order that this reversing gear may work with the same ease both ways the weight of links V, K and lever I has been counterbalanced by the counterweight Q. This type of reversing gear has now been in use for several years and has proved a success in every way.

*Gas Producers.*

For rail mill No. 1 and the billet mill (plans for which have not been fully decided upon as yet) four Fraser-Talbot producers have been furnished by the Wellman-Seaver-Morgan Co. They are 11 feet in height, with 11 feet outside and 9 feet 6 inches inside diameter, and are placed 18 feet between centers. The coal consumption per producer is 25 tons in 24 hours. They are equipped with dust catchers, water seal, mechanical feed and conveyors. The coal bins provide storage for 1½ days' consumption. The coal is supplied by means of buckets carried by gantry cranes and thence delivered by conveyors to the coal bin. This is not satisfactory, however, and arrangements have been made to install a receiving bin under the railroad track and elevate the coal with a bucket elevator supplied by Heyl & Patterson. The main gas pipe is 7 feet in diameter and the branches to the rail mill and billet mill are 5 feet 3 inches in diameter.

For the steam engines in the rail mill and those which will be erected in the billet mill a Weiss central condensing plant is provided, of 20,000-h. p. capacity.

**Rail Mill No. 2.**

The building for the small rail and splice bar mills is 1,425 feet long by 62½ feet wide. It has two transepts 62½ feet and various lean-tos. Recent changes in the plans include in this building also the structural mill, as indicated on the revised ground plan shown in Fig. 2. This plan also embodies other recent changes in the finishing departments now under construction or yet to be built. The No. 2 rail mill will have two 3-high trains driven by 44 x 48 Porter-Allen engines of the Southwark Foundry & Machine Co. The structural mill will have two 3-high trains, a 44 x 66 engine on the roughing train and a 44 x 48 engine on the finishing train.

**Open-Hearth Furnaces.**

As originally planned, the open-hearth department, with an annual capacity of about 250,000 tons, was to have both Talbot and ordinary stationary furnaces. At present only the latter will be built—six 50-ton furnaces, though the lay-out contemplates 16 additional. It is expected that open-hearth steel will be turned out by May or June, 1904.

**Merchant Bar and Plate Mills.**

The merchant bar mill plant for which contracts were recently let to the Morgan Construction Co., Worcester, Mass., is designed to take 6 x 6-inch billets and reduce them to various sizes of merchant bars. There are 8, 12 and 16-inch merchant mills, the engines for which are furnished by the Allis-Chalmers Co. A universal plate mill will furnish one outlet for the product of the open-hearth department. This mill will be driven by a 55 x 60-inch Mackintosh-Hemphill engine. The slabbing mill engines, furnished by the Mackintosh-Hemphill Co., are 46 x 60 inch for the horizontal rolls and 36 x 48 inch for the vertical rolls. The new finishing department plans also include storage yards for beams, channels, angles and Z bars, as indicated in the ground plan in Fig. 2.

**Power Plant.**

The power plant and the equipment closely related to it call for treatment at some length. Not only do the engines in themselves mark an epoch in blast furnace practice in this country, but they are probably grouped in the largest installation operated by gas—blast furnace or other—to be found anywhere. These motors are of the horizontal, duplex, double-acting, two-cycle type gas engine built by the De La Vergne Refrigerating Machine Co., of New York. They were built from the designs and under the patents of Ernest Körting of Hanover, Germany. Eight units of 1,000 h. p. each are too weighty an undertaking for any deviation from the original calculations of the inventor and his instructions were closely followed in the construction of the engines. Metric sizes prevail and there are other features of a foreign brand which in later work probably would be discarded. From a purely mechanical point of view the engines may be set down as a pronounced success. They have given no cause for anxiety from the time they were set in operation and are running with remarkable smoothness. The irregular loads and varying quality of gas have caused some occasional unevenness in the governing but this has been of small amount. Mr. Körting was a recent visitor and suggested a few changes, a slight variation in the shape of the ports, etc., which it is hoped will effectually remove even the slightest difficulty.

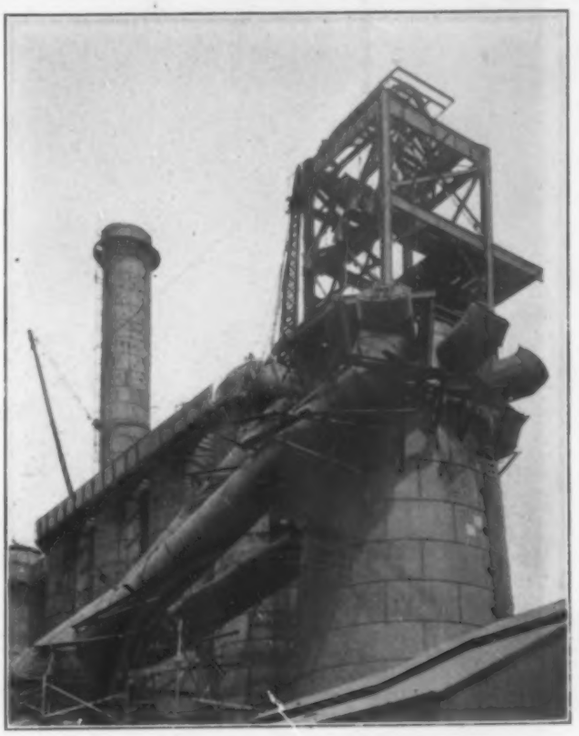


FIG. 13.—TOP OF BLAST FURNACE NO. 4, SHOWING EXPLOSION DOORS.

The engines have already been described in detail in *The Iron Trade Review*, but the features may here be summarized: Auxiliary gas and air pumps in tandem are driven from the main shaft by crank and rod. These pumps permit the two-cycle operation by compressing the combustible before admission to the explosion cylinder. The piston is long in proportion to the diameter and uncovers ports at the middle of the cylinder at the end of every stroke. The ignition is by electric spark and the conical governor controls the instant of explosion as well as the quantity of gas and air. The power cylinders are 24¾ inches diameter and 43 inches stroke and at 100 revolutions per minute develop 1,000 h. p. per unit.

Four of these units are direct connected to an equal number of alternating current generators built by the General Electric Co. The generators are of the 3-phase, 25-cycle, 440-volt type and at normal capacity give an output of 500 k. w. The electric generators are built to specifications calling for an ability to operate continuously with 50 percent overload and not then to exceed a rise in temperature of over 60 degrees Fahr. The remaining four engines are direct connected to 250-volt, 500-k. w. direct current generators of the Sprague type and with similar rating to the alternating current machines. One of the five direct current generators is direct connected to a 36 x 48-inch Porter-Allen engine and is

held in reserve pending any interruption in the operation of the gas driven units.

There are three exciter engines, 10 x 10 inch, 60 h. p., of the Harrisburg enclosed form. Four Ingersoll-Sergeant air compressors with two-stage air have a capacity of 925 cubic feet of free air per minute each at 100 pounds pressure. The steam cylinders are 14 x 16 inches and the air cylinders are 14¼ x 22¼ x 16 inches. These supply pneumatic tools, start the gas engines, operate the blast furnace bells, blow whistles, etc. The whistles for announcing starting and stopping are electrically connected and by means of magnets operate in unison, an item of no small importance in so large a plant.

Four steam-driven blowing engines—two 50 x 54 x 60 inches and two 52 x 60 x 60 inches—furnish blast for the Bessemer converters. There are eleven hydraulic pumps of the duplex, outside packed plunger construction and with cylinders 29 x 9 x 36 inches. The steam driven units are connected to a Weiss central condensing system.

All the apparatus so far described is contained in power house No. 1. The combination of units would suggest the possibility of driving the gas engines by a separate compressing system which would deliver the quota of gas and air direct to the working or explosion cylinders under the requisite pressure. There are some advantages in such a plan, the reduction in the number of auxiliary cylinders with their attendant apparatus, for instance, but the present arrangement has the merit of being constituted of independent units and a careful and accurate weighing of the relative values of the two plans, actual and proposed, calls for further experience of a practical character. The unique installation and the fact that it is not likely—in extent at least—to be closely duplicated in the near future has had undoubted weight in the design of the power plant at Buffalo and no avoidable responsibility was undertaken by the engineers.

This power house, No. 1, is 725 x 77 feet with a reinforced concrete floor supported by steel girders over a basement. An electric fan at each end furnishes a double heating system by overhead conductors. This and other heating apparatus installed by the Buffalo Forge Co. There are runways the length of the building for the 25-ton traveling crane built by the Morgan Engineering Co., of Alliance, O.

The switchboard was designed by the Lackawanna company and built by the Westinghouse Electric & Mfg. Co. Ample space is given and protection from accident to the unwary is afforded by the 3-foot high supporting platform which runs along the side of the building and is 250 x 15 feet.

FIG. 14.—VIEW IN CONVERTER WORKS. A NOTEWORTHY PIECE OF PHOTOGRAPHY. BY E. W. COUNTRYMAN, COMPANY PHOTOGRAPHER.

### Boiler Houses.

Five boiler houses are contemplated and of these two are in operation, one in process of construction and plans for two more are finished. No. 1 boiler house has 16 250-h. p. Cahall vertical water tube boilers fired with blast furnace gas, and furnishes steam for blowing engine house No. 1. No. 2 boiler house has 80 Cahall boilers of 250 h. p. each. Of these 32 are fired with blast furnace gas and the remaining 48 are coal fired and have Roney stokers and traveling coal hopper.

Boiler house No. 3 will have 32 Cahall boilers with connections for blast furnace gas. The buildings for boiler houses Nos. 1, 2 and 3 are respectively 65 x 85 feet, 65 x 480 feet and 65 x 200 feet. Boiler house No. 4 will have 20 Munoz horizontal water tube boilers of 350 h. p. each and No. 5 building will have 4 boilers of same type but of 350 h. p. The boilers in buildings 4 and 5 will be coal fired and supplied with shaking grates. The boilers are all equipped with grates as the coal is useful in starting the fires and is also serviceable on occasion as an aid to the gas fuel. There is a smaller power house containing two 25-h. p. units for emergency. The locomotive boiler house has four 75-h. p. boilers for heating purposes.

The pump house is 60 x 250 feet, and has five 5,000,000-gallon direct acting, duplex, triple expansion pumps built by the Wilson-Snyder Mfg. Co., of Pittsburg. These are used for the blast furnaces and general service. A Weiss condenser outside the pump house receives the exhaust steam. A connection with the water line of the Depew Water Co. is made for emergency and to supply drinking water. The main water supply is from Lake Erie and is received at an intake near the south end of the ship canal. It flows by gravity through a tunnel conduit to the pump house. The pumps mentioned above deliver it to a steel water tower near rail mill No. 1. Ultimately from 60,000,000 to 70,000,000 gallons will be required daily.

### Blowing Engine Houses.

Blowing engine house No. 1 has the equipment brought from Scranton for initial operations and this will be discarded with the completion of the later designs. The old apparatus includes three horizontal engines of the Fritz type built by the Dickson Mfg. Co. These have cylinders 60 and 80 inches with 100 inches stroke. The other two engines were built by the I. P. Morris Co., and have cylinders 58 and 93 by 120 inches stroke and are of vertical beam type. The five engines are connected to a Weiss condenser. The supply of air is delivered to the furnaces at from 12 to 20 pounds pressure as may be required.

Blowing engine houses Nos. 2 and 3 will be on much more extensive scale. Each will be 425 x 77 feet and have a 35-ton traveling crane with a height of 30 feet under the hook. A set of eight power units will be installed in each house and these, designed and built under the direction of the Lackawanna Steel Co., will have every improvement that experience with other gas-driven engines has suggested. The power cylinders will be of horizontal Körting construction and the blowing equipment will be of the vertical type built by the Southwark Foundry & Machine Co. The engines will be driven by blast furnace gas and each unit will be of 2,000-h. p. capacity. The explosion cylinders will be 38½ inches diameter, 60 inches stroke. The auxiliary gas and air cylinders of the engines are 45¼ and 38¼ inches diameter and the "tubs" of the blowing engines are 76 x 60 inches. The engines will run 80 revolutions per minute. Each stands 31 feet above the floor. The first one will be ready early in January, 1904.

### Electrical Plant.

The electrical equipment is unusually thorough and a detailed account would go far beyond the limits of the present article. Some 450 motors are installed and present plans will increase this number to at least 1,000 in due course, the aggregate eventually being about 30,000 h. p. A very general use is made of induction motors, as will be noted in the mention made elsewhere in connection with the machine shop and other plant. The motors using direct current at 220 volts have specially heavy wound series fields designed by the electrical engineers of the company. There are few overhead wires and these are going underground as fast as the exigencies of construction work will admit. All cables are lead incased and enclosed in terra cotta conduits. All switches, meters, etc., are built to the company's specifications in every particular and the results under this departure are held to be thoroughly satisfactory.

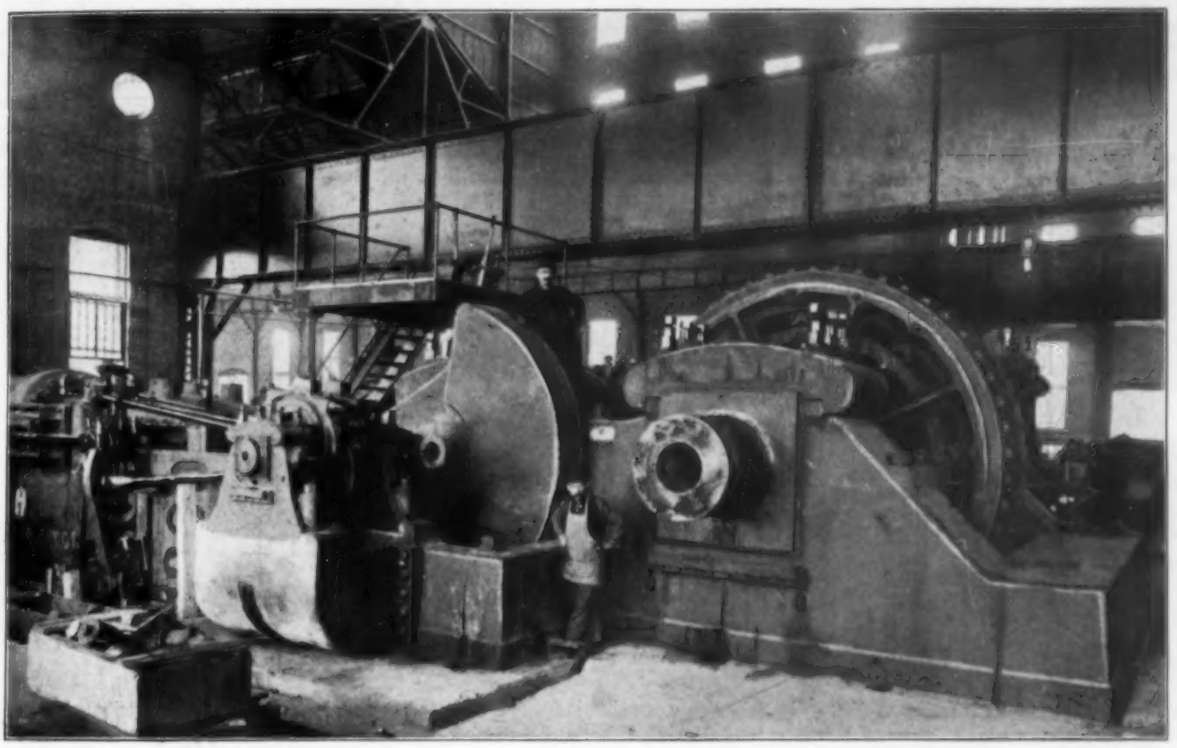


FIG. 15.—40X60 LACKAWANNA ENGINE IN RAIL MILL NO. 1.

The advantage of the independent operation of tools, through the general employment of electricity, need not be commented on. A breakdown in one part of the works does not interfere with any other, and one division or sub-division may be operated when other parts are idle. A sudden demand for additional power in one quarter is scarcely felt in so large an aggregate, the variations due to throwing on one machine or set of machines and stopping others substantially balancing.

### Machine Shop and Foundry.

The machine shop is 300 x 86 feet and has a 30-ton and a 20-ton traveling crane in the center span of 40 feet and two 10-ton cranes in the side aisles. The large cranes are 40 feet under the hook. These cranes furnished by the Morgan Engineering Co. The supporting columns are proportioned for 10-foot jib cranes of 5,000 pounds capacity. A standard gauge track runs through the shop and the 36-inch traverses the floor. Most of the equipment is new but a portion did duty at

Scranton before the migration to Buffalo. The former class includes a 10 x 10 x 30-foot Pond planer driven by a 30-horsepower induction motor; another motor is employed for lifting the cross rail. Most of the tools have individual motor drives but are belt connected. There is a Niles boring mill of extension type with a maximum capacity of 14 x 20 feet, 7-foot universal radial drill built by the American Tool Works Co., a Beaman & Smith 9 x 9-foot boring machine with 10-inch spindle. A number of Lodge & Shipley lathes have motor drives, the motor frame bolted to the back of the lathe cabinet and a swinging countershaft frame pivoted in rear of the back gears. An adjusting screw tightens up the belt from cone to cone and this swing does not interfere with the other belt. The induction motors are of course constant speed and the variation desired by the workman is obtained by the cone pulleys in the usual manner. About 120 men are employed in this department on repair and new work.

The foundry is 550 x 60 feet with 30-foot lean-to and four cranes, of 30 and 20 tons and two of 10 tons built by Pawling & Harnischfeger, of Milwaukee. The lean-to has one 8½-foot and one 5-foot cupola, with one air furnace at present. A 36-inch track runs through the building and a turn-table communicates with the yard track to the machine shop. One hundred men are employed in this department. There are special pits for roll casting and the ingot mold casting room has a hot metal track to the blast furnaces.

### Boiler, Forge and Other Shops.

The plate shop is 280 x 65 feet with standard and narrow gauge tracks. A 40-foot span by 15-foot Wellman-Seaver-Morgan Co.'s gantry is equipped with a lifting magnet and hooks, and a 65-foot gantry travels 100 feet. There is also a supply of hand jib cranes and differential trolley hoists on girders traveling on transverse tracks of suspended T rails.

The forge shop is 200 x 70 feet with two heating furnaces and nine forges. The equipment includes a 3,000-pound and a 1,150-pound steam hammer, a 7-ton drop hammer, traveling crane and 5-ton jib crane.

The bridge shop is another of the more important minor buildings grouped in the northeast portion of the site. After the first buildings were up the bridge shop carried on the greater part of the construction work. Other buildings comprise the pattern shop, pattern storage, carpenter shop, paint shop, store house and roll shop. The pattern shop is 100 x 50 feet and two stories high and the pattern storage building is the same size. The carpenter shop is 150 x 50 feet and the oil house is a two-story, 75 x 34-foot structure, containing eight steel tanks.

### Yard Equipment.

The visitor to the plant is struck by the unusual facilities provided for the rapid and economical handling of material from building to building, and from one point to another in the extensive area occupied with manufacturing and construction operations. The movement of material from the raw to the finished state is from west to east and from north to south, the plant being arranged, as appears from the plan view shown, over a series of parallel, longitudinally extended tracts—the coke ovens on the extreme western side abutting the lake shore, then in order the ship canal, ore docks, bin system, blast furnaces, power houses, steel works and the various descriptions of finishing plant. There are now 47 miles of standard gauge tracks in the yards and buildings and 8¾ miles of narrow gauge. Employed in handling material and product in the plant are 22 standard gauge and 12 narrow gauge locomotives.

Special service is provided by a number of steam locomotive cranes and electric gantry cranes. Of the former there are nine with a capacity of 10 tons at a radius of 12 feet, or 4 tons with a radius of 30 feet, without outriggers, and one with a capacity of 30 tons at 20 feet radius with outriggers, or 10 tons at 20 feet radius without outriggers. The electric gantry cranes, which are noteworthy for their number and capacity, include the following: One of 30 tons capacity and 40 feet span; two of 5 tons capacity, 40 feet span, with cantilevers 47½ feet on each side, giving total span of 135 feet; one 3-trolley, each of 10 tons capacity, 40 feet span, with cantilevers on each side of 60 feet, giving total span of 160 feet; one electric skull cracker gantry, 40 feet span; ten 20-ton gantries, 30 feet span, with cantilever 32 feet on one side and 18 feet on the other, giving a total span of 80 feet. The 20-ton gantries are at the coke plant.

The pig magnet shown in Fig. 17 is the invention of one of the company's engineers and has peculiar properties. The two groups of interior and exterior poles are held in slides in a circular case containing the energizing coil of the electro-magnet. When the case and the attached magnet poles are dropped in contact with a pile of pig iron, the sliding poles withdraw into the case and the projecting ends are equally applied to the irregular surface of the pile of metal. On raising the electro-magnet the pull is evenly distributed between the several units of the polar surface and the mass is therefore lifted the more effectively. This magnet has a capacity for lifting a ton of pig iron.

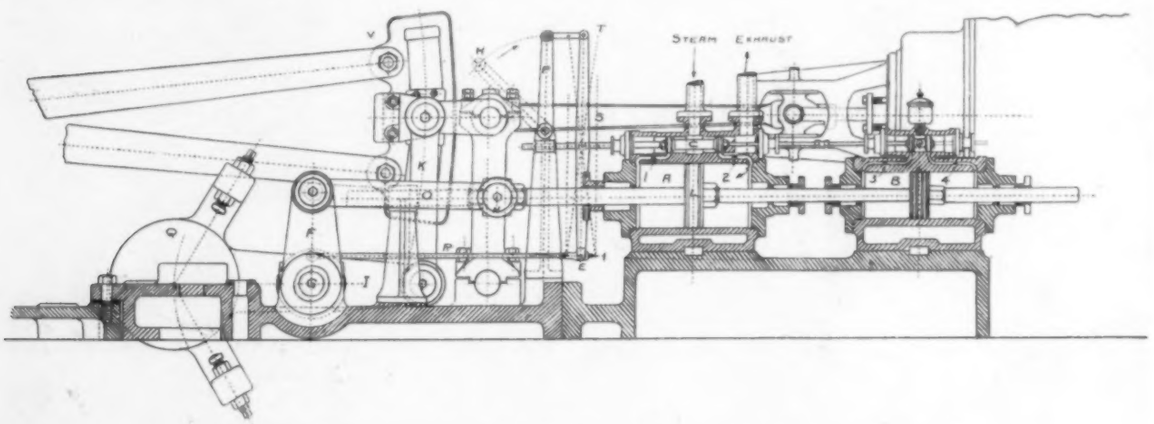



FIG. 16.—REVERSING GEAR MADE BY WM. TOD CO. FOR THE LACKAWANNA STEEL CO. ENGINES.

### Railroad Facilities.

The South Buffalo railway is a subsidiary interest with a special charter as a terminal railroad. It furnishes connection for the plant with the 26 railroads centering at Buffalo. Outside the Lackawanna Steel Co. plant this road has 14 miles of track and at Buffalo it has track privileges at the D. L. & W. depot. Morning and evening trains are run for the employes from the foot of Main street, Buffalo, to the plant, a distance of about four miles. The road has handled about 5,000,000 tons of freight a year. Repair shops and a round-house are now being built.

### Historical.

The Lackawanna Iron & Coal Co. was organized April 2, 1853, to operate anthracite coal mines and iron works at Scranton, Pa., and the original product was merchant iron from puddled material. In time iron rails were manufactured and later steel rails, the Lackawanna steel rail having become famous for the severe tests withstood. The Scranton Steel Co. was organized in 1881 for the manufacture of steel rails and in 1891 this company and the Lackawanna Iron & Coal Co. were consolidated under the name of the Lackawanna Iron & Steel Co. The anthracite mines were sold in February, 1899,

and since that time the company has devoted itself exclusively to the manufacture of steel rails, billets and merchant iron. The annual capacity was 500,000 tons. The company operated three blast furnaces in Scranton, which are now dismantled, portions of the equipment being eventually transferred to Buffalo. It also has under lease two Bird Coleman furnaces at Cornwall, Pa., and one North Cornwall furnace at the same point. Two Colebrook furnaces at Lebanon, Pa., it owns. The five last named furnaces are still retained.

Heretofore the company has been dependent upon Connellsville coke. When the decision was made to remove to Buffalo, coal lands were acquired in Indiana and Cambria counties, Pennsylvania, and the company began the erection of a coke plant at Lebanon to supply the furnaces in that district. The same coal properties will be drawn upon for the retort coke ovens at South Buffalo.

The tract at South Buffalo was acquired in April, 1899, and on Dec. 29 of the same year the capital stock of the company was increased from $3,750,000 to $25,000,000. Ground was broken in the spring of 1900 and construction work has been in progress ever since. The Lackawanna Steel Co. was incorporated under the laws of New York in 1902 with a capital of $40,000,000 to absorb the Lackawanna Iron & Steel Co. and the Lackawanna Coal & Coke Co., the latter having bituminous coal properties. Of the $40,000,000 capital $35,000,000 was issued. On March 3, 1903, an issue of $20,000,000 5 percent first mortgage bonds was authorized, of which $15,000,000 was issued.

The plans carried out at South Buffalo involved the removal of the blast furnace and Bessemer and rail mill plants from Scranton and this was accomplished in 1902. No. 1 blast furnace at the new plant was put in operation Feb. 19, 1903. The Bessemer works and rail mill were started in October of this year, the first rail being rolled on Oct. 21.

The new plant is largely after the plans of Henry Wehrum, general manager of the company until the fall of 1903, when he resigned, and associated with him was F. du P. Thomson as chief engineer. The construction work now going on is under the direction of George L. Reis, vice president, S. B. Sheldon, general superintendent, and Alex. K. Hamilton, chief engineer. The ultimate capacity of the plant as now laid out is expected to be 1,000,000 tons of Bessemer steel products per annum and 250,000 tons of open-hearth steel products.

In addition to its coal mines in Pennsylvania, the company has ore properties on the Mesabi range in Minnesota, and is presumed to have long time contracts for ore, from old-range Lake Superior mines. Its extensive Cornwall ore holdings will supply its furnaces in the Lebanon Valley, Pennsylvania from which pig iron will be shipped to Buffalo.

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It is expected that at an early date the Mexican Government will place a high protective duty on all imports of steel products. This action will be taken to protect the Monterey steel plant, which has been in operation for a year and which has not proved the success anticipated according to the admission of its own officers. On account of the high cost of coal and coke, the company has not been able to make steel to compete with American manufacturers. The railroad companies of Mexico are opposed to any increase in the present tariff on steel. They now obtain their steel from the United States, and the imposition of a prohibitive duty on steel would, they claim, work havoc with contemplated plans of extension, as they would be compelled to buy rails from the Monterey plant at much higher figures than the American prices.

FIG. 17.—PIG IRON LIFTING MAGNET.

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The Abrasive Material Co. will open a branch store at 54 W. Randolph street, Chicago, about Jan. 1. It will carry as complete a stock as possible of "Abrasive" emery emery wheels, so as to make prompt shipments in this territory.

# The Chicago Iron Trade in 1903.

The course of the iron market during the year just brought to an end is in marked contrast to that of the year previous and is in a measure reminiscent of 1900 in the meteoric fall of prices. From beginning to close, 1903 has been a year of declining values, and the causes that have conspired to bring this about are of no small importance even to those outside the iron trade. In some lines, notably pig iron and iron bars, the pendulum of prices has swung from one extreme to the other during the period under review; on other products associations have been able to maintain prices or to revise them in a decorous way. All movement is rhythmical, that of markets included, and time has proven that after going to one extreme a reaction in course of time carries them to the other extreme, and then eventually comes a reaction. If the high prices of 1902 were the outcome of the car and fuel famines of that and the previous year, the low prices and decreased consumption that ruled during 1903 were a secondary result of the same causes.

Another factor that has had some influence on the iron and steel trade during the year, was the general uncertainty of the public with regard to iron and steel stocks. This is best shown by the movement of the stocks of the United States Steel Corporation. Participating in the tremendous reactionary movement in securities, these stocks have apparently outrun the decline in iron products themselves. In January, 1902, the preferred stock sold at 97¾ and its common stock at 46¾. By December, 1902, the preferred issue, after a slow decline, sold at 79 and the common issue at 29¾. During the present year the course of quotations has been steadily downward. In January, 1903, steel preferred sold at 89¾, but on November 10, 49¾ was touched, this being low point. Since that time the tendency has been somewhat upward in sympathy with the improvement in general business conditions, though 59 marks the limit of the recovery. The common shares, too, opened the year 1903 at their best, selling about 39⅞ early in February. They reached bottom on Nov. 10 when the price was 10. Moderate improvement has been noticed since then, but no better price than 12⅜ has been attained. The selling of these shares has been of enormous proportions, the estimate of reliable authorities being that it exceeded six and a quarter million shares of the common and three and a quarter million of the preferred. The shares of other iron industrials have suffered great declines also, in nearly all cases prices falling below the values of tangible property behind the stocks.

### Features of the Year's Declines.

In recording the fluctuations of the year, special attention should be given to the decline in pig iron. In January last Northern No. 2 foundry was selling at $25 Chicago; today the price is $14.50 Chicago. At the opening of the year, Southern No. 2 foundry sold at $24 and at the close $13.35. Earlier in December, however, Southern foundry iron sold 50 cents a ton lower. The spread between the highest and lowest prices of the year on Northern and Southern irons amounted in the case of the former to $11, and in the latter to $11.15. The decline in bar iron during the year amounts to $12 a ton, this product selling in March at $38 and in December at $26. Sheets also have declined slowly but surely, No. 27 black selling in March at $58.30 and in December at $49.30, a difference of $9 a ton. Soft Bessemer steel bars have also declined $6 a ton, and Bessemer billets have dropped from $35 Chicago in February to $24 at the close of the year. Plates, structural steel and heavy rails are the only products that have suffered no variations in "official" prices during the year, excepting possibly the premiums that were obtained for prompt shipment of plates during March and April, amounting to $3 to $5 a ton, which were removed with the general weakening of the market. Special mention might be made of merchant pipe, which stands out prominently in the list with a practically undiminished demand throughout the year. With the exception of sizes 7-inch to 12-inch steel pipe, random lengths, discounts on which were raised in March from 74 off to 70 off, there has been no change in prices on this product during the year. Cast iron pipe, on the contrary, has weakened from $35 a ton for 4-inch, obtained in January, to $27.50 a ton in December.

### Characteristics of the Year.

The year under review has been a noteworthy one from many standpoints. The car and fuel famines which were dominating factors in the year previous, were felt acutely in the first three months of 1903. A number of furnaces in the west were forced to bank or go out of blast in this period because of their inability to get coke, while furnaces in the South piled up thousands of tons of pig iron in their yards because of the short supply of cars. This inefficiency of railroads, though it gradually remedied itself, created considerable confusion at the time and compelled many foundrymen to reenter the market for immediate wants and pay several dollars a ton more than the price named in their contracts. The supply of cars increased after March and no further trouble was experienced from this source in the balance of the year.

There were no importations of foreign pig iron or steel worth speaking about except in the first quarter, German and British producers withdrawing from this market in March as their own home demand improved. With the decline in American consumption in the last half of the year, an outlet for the excess production of the constituent companies of the United States Steel Corporation had to be provided, and the United States Steel Products Export Co. was organized by this concern for the purpose of handling and further developing the export trade, and the tonnage exported has more than offset that imported.

The disruption of the Southern Furnace Association in October, and the concerted effort made by Northern producers of pig iron in that month to prevent further declines in prices by curtailing the production 25 percent for the balance of the year, reducing the output in the last quarter at least 1,000,000 tons, are also conspicuous events in the year's history.

Of great importance to the coke trade was the announcement of the H. C. Frick Coke Co. in November that it would again take orders from the general foundry and furnace trade. This company withdrew from the market last year, when he United States Steel Corporation decided to conserve its supplies of coke for the consumption of its own plants only; but with so many mills and furnaces shutting down, it was compelled to seek other fields for its surplus production.

The reductions in the price of billets and steel bars at the meetings of producers of these products early in November, when Bessemer billets were cut $4 a ton and open-hearth $5 a ton, and steel bars $6 a ton, were important, resulting in a somewhat improved demand for these products.

### New Plants.

In the West, the new plants that have been put in operation are those of the Inland Steel Co. at Indiana Harbor, Ind., of the Deering Steel Works at South Deering, Ill., and of the Grand Crossing Tack Co. at South Chicago. The plant of the Fort Wayne Iron & Steel Co. at Fort Wayne, Ind., was built to replace the dismantled bar mill of the American Rolling Mill Corporation at Muskegon, Mich., which concern owns a controlling interest in the new works. The bar mill of the National Rolling Mill Co. at Hartford City, Ind., was torn down late in the year and is being rebuilt at Vincennes, Ind., with twice the former capacity. The American Steel Foundries Co. commenced the erection of a large plant at Indiana Harbor during the year, and at the same city the Ward-Dickey Steel Co. is building a sheet mill. The Standard Forging Co. has also erected a plant in this town for the manufacture of forging and axles, etc., and several minor metal industries have settled there in the year.

### The Outlook for Prices.

Interest naturally centers at the present time in the probable course of the market in 1904. It is not believed that prices on those products which suffered most in the shrinkage of the past year will soon soar to anything like the plane they reached in 1902, but they may nevertheless advance to a point

that will insure stable conditions and a fair profit to producing interests. The reaffirmation of the present schedules on plates, rails, structural steel, billets and steel bars at the meeting of producers represented in the various pool agreements on these products, held in New York in the middle of December, created general satisfaction and did much to steady a market that was inclined to break. The production and distribution of heavy finished materials during 1903 was characterized by a marked absence of those bearish influences that did so much to depress prices on other metals, this being due largely to the unanimity of opinion and action of producers throughout the year, and to the fact that on these products prices were kept down in 1902. The conviction is forced that to the restraining and commanding influence wielded by the United States Steel Corporation and other aggregations of capital, is due the avoidance of a disastrous reaction. These interests, controlled by men of good judgment and executive ability, and directed along a line of conservatism, not only prevented a general boom in prices in 1902, but made impossible a panicky market in 1903.

Nineteen Hundred and Four is ushered in with the iron and steel markets in better condition than for some weeks, although specifications are coming in slowly and several plants in various parts of the country are idle in consequence. A cloud that hovers over the horizon is the possibility of trouble with organized labor in the coming year, though thus far the wage reductions announced have been accepted as justified by market changes. The Amalgamated Association, under wise leadership, is co-operating with mill operators in putting the wages of iron and steel workers on a basis compatible with the less favorable conditions in the iron and steel trade. This is in marked contrast, however, to the bitterness with which union workers and their leaders in various metal working lines are opposing their employers in the stand the latter have taken for the maintenance of the open shop or for increases to the hours of labor.

## Pig Iron.

Events in the closing months of 1902 foreshadowed in a measure the probable course of the market in 1903. In November, 1902, leading Southern producers opened their books for deliveries in the second and third quarters of 1903 on the basis of $24.15 Chicago for No. 2 foundry. Northern furnaces were asking at this time $24.50 for the same shipment and the same grade of iron. Producers in both localities were months behind in their contract deliveries, and melters had been buying spot iron, paying $5 to $10 a ton more than the price named in their contracts in order to keep their cupolas in operation. Under the existing conditions, foundrymen refused to consider their wants so far ahead, and the demand for forward deliveries weakening, Southern quotations were reduced $1 a ton and Northern prices 50 cents a ton before the year closed. On Jan. 1, Northern No. 2 foundry was selling on the basis of $24 Chicago and Southern No. 2 foundry at $23.15 for deliveries in the second half, with iron for prompt shipment held at $25 and $24 respectively for Northern and Southern grades.

An advance of 50 cents a ton in the freight rate from the Ohio river to Chicago which went into effect Jan. 1, increased the price of Southern No. 2 foundry at Chicago to $23.35. There was an insistent call for spot iron throughout January, the bulk of which was supplied by Central Western furnaces and those isolated stacks in the South which had not sold their output far ahead. Local furnaces were not factors in the Chicago market at this time, having their capacity taken for the first half of 1903 providing the undelivered tonnage due in 1902 was made good during this period. Prices on all grades hardened in the first two weeks of the year, the fuel famine in the North and the car scarcity in the South offsetting the weakness developed in the last weeks of December. These exasperating conditions became very acute again in January, and compelled one of the leading producers in the South to withdraw from the market for the first two months of the year. This concern had sold heavily for deliveries in the first half of 1903, and owing to the irregularity of shipments had carried over from 1902 a large tonnage which should have been shipped in that year. To catch up on these orders, the tonnage produced in January and February was reserved to apply on the most delinquent contracts. Other furnaces had a considerable tonnage piled in their yards awaiting cars, but by the end of March all were in good condition so far as back orders were concerned, with the possible exception of shipments on orders for low grade irons. Charcoal, malleable Bessemer and high silicon irons were very scarce at this period, most of the local stacks producing them being idle because of the fuel famine; and consumers were compelled to buy standard Bessemer at $24.50 and substitute it in their mixtures. There were some offerings of foreign iron in this month, dealers asking $22.35 Chicago for March delivery of a Middlesboro, Eng., iron equivalent to Southern No. 3, but it found few buyers.

The bearish attitude which foundrymen had shown towards the market on the question of their future requirements, resulted in the announcement in January by the Southern Furnace Association, which was still the dominant factor in the Birmingham district, of a reduction of 50 cents a ton on all foundry grades, making No. 2 foundry, for deliveries in the last half, $18.50 Birmingham, or $22.85 Chicago. Iron for delivery in the first half was held firm at $19 Birmingham for No. 2, and for spot shipment 50 cents to $1 a ton additional was asked. Sales were being made by non-association furnaces at 50 cents below these prices, a fact which foundrymen were not slow to use in bearing down the pool quotations, though continuing the policy of buying only as their needs dictated.

The policy of the Southern independent producers throughout the year is worthy of special mention as it exerted a powerful influence on the situation at all times. These interests practically controlled the Birmingham market until the disruption of the Southern Furnace Association in October, generally selling at 50 cents below pool quotations. By not only meeting but anticipating cuts in pool prices the non-association furnaces were enabled to take the bulk of the business offered, and generally at a higher average price than was obtained by those in the association, and by serving the foundryman's purpose in helping to break the market won friends for themselves and familiarity with their irons.

Following the reduction in January mentioned above, there was some dissatisfaction because quotations on the lower grades of iron were not reduced to meet the wishes of the leading consumers. These interests claimed that the prices for finished product did not justify them in paying $16.50 to $17 Birmingham for gray forge. There was a little buying during February, and before the expiration of the month association furnaces had weakened and were asking $18.25 for the second quarter, though maintaining $18.50 for the last half. Sales were confined largely to small lots to fill in uncovered gaps in the first half, no interest whatever being shown in the market for deliveries beyond this period. The coke supply to local stacks improved materially in February, however, as an offset to the irritating conditions in the South, and by March all were in operation again. There was a brisk call for malleable Bessemer in February, and a large tonnage was disposed of at $23 Chicago. Valley furnaces, however, continued to supply the most pressing needs of malleable foundries in this section, offering standard Bessemer for quick shipment at $23.75 Chicago. Prices on Southern foundry grades weakened in March, and while no official change was made furnaces were covertly inviting orders on the basis of $18 Birmingham for No. 2 for deliveries in the last half. There was a brisk demand for basic iron in March, 15,000 to 20,000 tons being sold in this market at $18 Birmingham. There was also considerable inquiry for charcoal, malleable Bessemer and low grade irons at this time, though these were withdrawn on account of the high prices quoted. On April 1, the Southern Association furnaces reduced their quotations $1 a ton, offering No. 2 foundry at $17.50 Birmingham for shipment from July to December. Iron for the second quarter was held at $18 Birmingham for No. 2. Instead of steadying the market and increasing the orders, the cut served only to weaken the confidence of buyers and all inquiries were withdrawn. Independent producers were asking $17 to $17.25 Birmingham, and later in the month $16.50 for No. 2 foundry, and at such prices were taking what little business was offered. Northern foundry grades were also quoted lower in April, No. 2 foundry being offered at $21.50 to $22 Chicago. A sale of 6,000 tons of malleable and standard Bessemer in this month to a local car wheel interest on the basis of $21.75 Chicago for the former made a new and lower level for that grade of iron. Silvery irons were firm through-

out the month owing to their scarcity, and 8 percent to 10 percent silicon sold at $31.30 Chicago.

In May, the order let by the Pullman Co. for 1,200 tons of Northern No. 2 foundry and 1,200 tons of Northern No. 3 which was closed on the basis of $19.50 Chicago for the former —$2 below the schedule in force at that time—resulted in a reduction of 50 cents a ton on all grades before the month closed, a disordered market ensuing. The product of non-association furnaces also declined in May to the basis of $15.50 for No. 2 with reports current that $15 had been made. Disturbances in the ranks of labor added to the complexities of the situation at this time, many melters taking advantage of the strikes at their various plants to cancel orders placed at the high prices a few months back, depending on the "spot market" to supply their immediate wants, which it was safe to figure, would be furnished at several dollars per ton below their canceled contracts.

At a meeting of the Southern association on June 1, a cut of $2.50 per ton was made, making the price of No. 2 foundry $15 at Birmingham. Independent producers had in the meantime lowered their prices to the basis of $14.50, and before the month closed were openly selling at $14. The large implement makers still kept out of the market, and though there was a good volume of buying from other sources, the orders placed rarely exceeded 500 tons for deliveries in the next 60 days, with the possible exception of these from pipe manufacturers whose monthly requirements ran into thousands of tons. The bulk of the foundry trade was waiting on the action of the harvester combine, and this concern was waiting for lower prices. The market continued to sag through the month and at another meeting of the association in Chicago, July 10, prices were further reduced $1.50 a ton, or to the basis of $13 for No. 3 at Birmingham, this grade being adopted at the same time as the standard for all future computations. There was considerable dissatisfaction expressed by the trade that the leading interests did not lower their prices to the basis of $12 for No. 2, which would have brought many buyers into the market, including the leading implement manufacturers. Local irons had weakened during the month in sympathy with the Southern product, No. 2 foundry being quoted in July at $17.50 Chicago. Notwithstanding these reductions, however, independent furnaces continued their active campaign of bearing the Southern market, offering all grades on the basis of $12.50 for No. 2 Birmingham, or $16.85 Chicago, $1 below association prices.

In August a heavy buying movement took place, the International Harvester Co. placing contracts in this month for over 100,000 tons, of which 75,000 tons went to Northern furnaces and the balance to Southern interests, those outside the association getting the bulk of it. The Northern iron was bought at about $17 Chicago, deliveries extending into March, 1904, and the Southern iron at about $12 Birmingham, or $16.35 Chicago. The sales of malleable irons during this month were also very heavy, estimated at 100,000 tons, the bulk of which was closed on the basis of $17.50 Chicago, though a considerable tonnage was moved at $17. Basic iron also sold freely, the inquiry representing 20,000 tons, one lot of 4,000 tons for delivery in the third quarter of the year being closed at $12.25 Birmingham. There was no diminution in the buying throughout the month, and in quantities ranging down from 5,000 tons a number of Western foundrymen negotiated for the iron they expected to use in the ensuing six to nine months. The market now being firmly established on the basis of $12 Birmingham for No. 2, the Southern Association, members of which had taken little of the tonnage mentioned above, lowered its schedule on Aug. 17 from $13.50 for No. 2 to $12, but allowing agents a leeway of 25 cents a ton on orders for 1,000 tons or more. Northern irons were also reduced to $16.50 Chicago for No. 2. The independent interests cut prices 50 cents a ton and were inviting orders at the close of the month on the basis of $11.50 Birmingham, or $15.85 Chicago. The association furnaces managed to share in the fag end of the buying movement, and in small sized lots booked a considerable tonnage, the bulk of which came from the smaller consumers. Independent furnaces in the South now commenced to withdraw from the market, some for the reason that they had sold their capacity for the balance of the year, and others that prices were getting too near their cost line. The International Harvester Co. was still in the market for 20,000 to 25,000 tons of foundry grades and this it bought in small lots at various prices in the ensuing weeks.

September was quiet, transactions being confined to small lots for prompt shipment. Before the month closed, independent producers were taking orders on the basis of $11 Birmingham and the Northern furnaces at $16 Chicago. Producers and consumers now commenced to agitate for a reduction in the freight rate from Birmingham to Chicago, which ended successfully, the railroads south of the Ohio river making a concession of 50 cents a ton on all iron shipped from Birmingham to river points, the same going into effect Oct. 10. An effort to induce Northern roads to take off 20 cents from the river to Chicago failed, and the freight from Birmingham to Chicago remained at $3.85 during the balance of the year. In September, the Southern Furnace Association, at another of its meetings, while reaffirming the $12 schedule to Western foundrymen, established the price of $11 to Eastern melters, an act which created considerable feeling against the Association in this territory.

There was little buying during October, the month being distinguished chiefly for the breaking up of the Southern Furnace Association and the consequent removal of the $1 preferential in favor of Eastern foundrymen. No. 2 foundry dropped quickly to $10 Birmingham, this price being made by the erstwhile "independent producers" and quickly met by those interests formerly members of the Association. Northern irons at this time were holding at $15.50 Chicago for No. 2 foundry. October was conspicuous also in that in this month the first concerted effort was made by both Northern and Southern producers to provide a plan to bolster up the market and prevent accumulations of stocks. A meeting in Pittsburg on Sept. 30 of representatives of over 100 Northern merchant and steel works furnaces decided to curtail the production of pig iron 25 percent below the amount produced in September in the remaining months of the year. No plan was decided upon, each interest being allowed to follow its own inclinations so long as it reduced the output to the necessary point. As a matter of fact the reduction made was ultimately to 50 percent of the September output. The Southern furnaces proposed a similar movement, but it was not carried out. The Eastern furnaces also decided to curtail production 20 to 25 percent, making the total reduction of output in the remaining months of the year approximately 1,000,000 tons.

The market was without material change during November, buying being confined in the main to lots averaging 200 to 500 tons. Foundrymen were anticipating lower prices and a large number had still to cover for their requirements in early 1904. Furnaces invited offers at $9.50 and later at $9.25 Birmingham, but found few takers. In December $9 was reached and Northern irons touched $14, and at these prices a large tonnage was moved. There was some disposition to contract for requirements in the first half of the year at these figures, but producers refused to consider orders for deliveries extending beyond March except at higher prices. The market continued to improve with the heavy buying, Southern No. 2 advancing to $9.25 Birmingham by the middle of the month, and a week later to $9.50. Northern irons also showed increased movement, the year closing with a firmer market. All the furnaces are well sold up for the first quarter of the year, and not a few have considerable tonnage on their books for deliveries extending to July.

### Iron and Steel Bars.

Bars have shared in the vicissitudes of the year. The trading in the first half was more satisfactory than in the second, consumption from January to June being almost parallel to the high water mark of the year previous. From mid-summer the demand gradually dwindled, however, mills being hard pressed in recent months to get specifications. Iron has suffered more than steel, selling in December at $12 a ton less than the highest price of the year, while steel fell only $6 a ton. Steel has maintained a higher average price throughout the year, the reverse of conditions twelve months ago. There was no change from 1.76½c until November, when with the cut in other materials steel bars were reduced by the manufacturers $6 a ton. Bar iron has dropped on an average $1 a ton each month since March, when $38 was ruling. This weakness can be charged in a large measure to the aggressive competi-

tion of the many small manufacturers, and also to the decline in pig iron and scrap. Steel producers never lost their control of the market, the combination interests having little or no competition. Early in the year the pool decided not to make concessions to jobbers. This stand was of far-reaching importance, bringing producers into more direct touch with consumers. At the beginning of the year iron bars were quoted at 1.80c and steel at 1.76½c Chicago, an extra 30 cents having been added Jan. 1 by the action of railroads in advancing the freight rate from Pittsburg to Chicago that amount. This parity was not maintained long, however, for owing to the increased demand for steel and the slight call for iron the latter was reduced $1 a ton. The buying for January, which was confined largely to steel, came from those consumers whose contracts had expired with the end of 1902. No concessions, however, were allowed by mills, and all sales were made on the basis of 1.76½c. The tonnage booked in the month was heavy, exceeding the total of the three months previous. February and March were also good months for producers, iron advancing from $35 to $38 a ton in this period. There were some sales of foreign heavy steel rounds in February, a local importer disposing of 4,000 tons in the Western market, ranging in size from 3½ inches to 7 inches, at 1.85c base Chicago. The plan to combine the independent bar iron mills in the West, which had been under negotiation for some time, was abandoned in March and several efforts since made to revive it have failed. Iron fell off $2 a ton in April, consumers continuing to give preference to steel wherever possible because of its lower price. That portion of the implement and wagon trade whose contracts ran from July to July sounded the market in the month. The year previous their orders for 1902-1903 deliveries had been taken at 1.65c Chicago, providing they were placed before July 1, on which date an advance of $2 went into effect. Now, with the market $2.30 above the figure in their expiring contracts, these consumers were anxious to learn if the mills would accord them the privilege enjoyed the year before. This was refused, however, and the inquiries were withdrawn. During the next four months, the buying was marked by an absence of long-time contracts. Trade had fallen off in subsidiary lines in the meantime, and as consumers had large stocks of machines on hand and considerable tonnage still coming to them on their old contracts, the market was dull and featureless. The only event of importance in this period was the heavy purchases of the International Harvester Co., who in August bought 50,000 tons of steel bars, 1,500 tons of bar iron and 600 tons of nut iron. The price at which the steel bars was closed was not made known, but it was understood the buyer was protected against any decline in the market. In the meantime, iron had dropped to $30 a ton, and for some time steel mills had been guaranteeing their quotations to induce buying. The market continued to grow weaker in both products, and on Nov. 4, at a meeting of the steel bar pool in New York, quotations were reduced to the basis of 1.46½c Chicago. Steel tire and toe calk steel were also cut $6 a ton, and spring steel $5 a ton. In this month iron was selling at 1.40c Chicago, but continued to recede until it touched 1.30c—$26—in December. There was some improvement in the buying of steel after the cut in November, but owing to the weakness in other branches of the iron and steel trade and the depressed state of business in all subsidiary lines, the market was without any snap for the balance of the year.

### Rails.

On Jan. 1 last, the United States Steel Corporation had orders on its books for standard sections for delivery in 1903, with 2,350,000 tons on the books Jan. 1, 1902, for delivery in that year. The undelivered tonnage on mill books at the tonnage carried over from 1902, estimated at 400,000 tons, made a total of 2,200,000 tons for rolling in 1903, as compared closed the year previous, approximating 1,200,000 tons, and other manufacturers, 600,000 tons, which, with the undelivered close of 1903 for delivery in 1904 is estimated at 600,000 tons, while the new business is considerably smaller than that under contract at the close of 1901 or 1902. Several plants were idle for short periods in the fall of the year or were changed on to other products as a result of the curtailment of specifications from railroads owing to the stringency in the money market and the general adoption of a policy of economy in all departments as a result of the decline in industrial values. With the decline in values of some products certain railroads having a relatively small traffic in iron and steel looked for reductions in rails. Producers, however, were of the opinion that in view of the steadiness of rail prices in preceding years, with steel billets considerably higher, the quotation of $28 should be continued. This price was established in April, 1901. Following the irregular market of 1898, the price of rails advanced rapidly until in November, 1899, it touched $35. This held until late in the summer of 1900, when $26 was made, after which the price advanced and later went down, maintaining an average of $28, which ultimately became the official price, remaining unchanged since. One conspicuous fact of the year is the small tonnage that was imported from abroad, as compared to the heavy demands on foreign makers the year previous.

In January and February there was a fair inquiry from the interurban and electric roads. Owing to the tightness of domestic mills in the matter of deliveries, however, foreign steel rails were sought and offered in Pittsburg in the latter in considerable quantities, 40-lb. rails being held at $37 and 60-lb. at $34. Light rails fell off in this month and prices were reduced to attract buyers. The demand for heavy sections continued brisk in March, electric and steam roads placing orders aggregating nearly a quarter of a million tons. In this month producers advanced prices on all orders less than 500 tons and more than carload lots to $30 per ton, the minimum previously being 200 tons. The supplementary orders from railroads increased in April, but the inability of mills to handle them caused purchasers to seek foreign markets for their wants. Mills withdrew from the market in May for 1903 delivery, having sold more than their capacity and falling behind in shipments. The buying for 1904 was started in June with large purchases by the Pennsylvania and Southern Pacific railroads. Other important lines followed. Buying has been spasmodic in the balance of the year, the mills having 1904 orders estimated at 1,250,000 tons on their books. Light rails were in good demand at all times of the year, but no such fancy prices were obtained as in 1902. From the high level at which they sold last year they have dropped to the basis of $26 for 25-lb. rails and $28 for 12-lb. rails. A movement is on foot for some understanding between the manufacturers of light rails.

### Sheets.

In the year just closed sheets have shown the greatest fluctuations, the declines coming from the aggressive competition of independent mills. A brief respite was enjoyed by the combination interests in the second quarter, due to the difficulty experienced by the outside manufacturers in securing sheet bars either at home or abroad at prices that would enable them to compete. But since the general collapse of the steel trade in summer the independent makers have practically made the market. Some of the outside mills were compelled to shut down for brief periods in April and May, which was the only period in the year when it was impossible to obtain concessions on prices and when premiums were asked for prompt deliveries. Efforts were renewed in the spring by the leading independent sheet and tin plate manufacturers looking to consolidation of interests that would make them independent either of the United States Steel Corporation or the foreign market in the supply of billets and sheet bars. Several plans were considered, the one that received the most consideration being the proposal to combine all the independent sheet and tin plate plants west of the Allegheny mountains and erect sheet bar mills that would provide sufficient tonnage of bars for the continuous operation of their respective mills. The negotiations extended over several months, but with the weakening of the steel market and the increases to the domestic supply of bars in the completion and operation of several independent plants, projected the year previous, a number of concerns lost interest and withdrew. Out of the negotiations, however, resulted the formation in August of the United Sheet & Tin Plate Co., with headquarters in Pittsburg and Columbus, controlling plants having an estimated output of 40,000 to 50,000 tons of billets, sheet and tin plate bars, and 30,000 tons of black sheets, plate and tin plate and galvanized iron, etc.

January opened quiet, with mills making concessions of $1

a ton from the schedule of a leading producer, black sheets, No. 27 gauge, being nominally held at 2.76½c Chicago, and galvanized at 3.25c for the same gauge. All the mills had a fair tonnage on their books at the start of the year, but when in February it became apparent that the independent producers were experiencing trouble in securing sheet bars, prices became firmer and demand heavier. A large tonnage was booked in that month, and buying was liberal also in March, producers discontinuing all concessions and holding strictly to schedule quotations. Toward the end of the month, owing to the arrears in deliveries from mills, local jobbers advanced prices on galvanized sheets $6 a ton for small lots from store and $2 a ton on mill shipments. In April, black sheets were selling at 2.91½c for No. 27 gauge, independent producers and jobbers asking premiums of $2 to $3 a ton above the quotations of the American Sheet Steel Co. on lots for prompt delivery. An advance in corrugated material was also made in this month, consisting of 10 cents a square on painted and 20 cents on galvanized. There was a heavy buying throughout the month, the market hardening all round, some mills asking 3c for No. 28 gauge. In the latter part of May the market weakened and regular quotations fell off $1 a ton. The talk of a general advance in prices which was so conspicuous in April disappeared entirely in May, largely because of the weakened demand, due to the metal workers' strike in this city and the ominous signs of further trouble with labor unions during the summer. Independent manufacturers were prevented from doing much selling in this month because of their crowded books and the withdrawal of foreign producers of sheet bars from the American market owing to the improved conditions at home.

The labor troubles in June weakened the market still further and extra discounts of 2½ percent were offered on galvanized sheets. Black sheets were sold in this month on the basis of 2.81½c for No. 27 gauge, and in July they fell off another $1 a ton, the month closing weak at 2.76½c, with the leading interest meeting the concessions made by independent producers. In August the buying of the implement trade stimulated the market, the International Harvester Co. placing contracts this month with leading interests for 15,000 tons of sheets. It was understood that the mills agreed to protect the buyer against a falling market. In September there was a further decline, mills selling on the basis of 2.71½c for No. 27 gauge. Before the end of October prices had weakened to 2.61½c; there was a further reduction in November to 2.56½c. In this month the American Sheet Steel Co. attempted to meet the cuts of the independent interests by announcing a reduction of $7 a ton, its last published list, though this cut was actually only $2 a ton below what was then being asked by the outside mills. The market steadied for a short time as a result, but the general weakness in other branches of the iron and steel trade enabled independent producers to meet the cut and shade it. Sales continued small, buyers confining their purchases to small lots, and in the early part of December following the meeting of the billet and sheet bar manufacturers in November, at which the price of billets was reduced $5 per ton, black sheets sold on the basis of 2.46½c per 100 pounds for No. 27 gauge and galvanized at 3.31½c, with reports current that concessions below these prices were being made. One feature of the market which stands out prominent in the sales of the year is that there was not a time in the whole twelve months when prices in Chicago were not $1 to $2 a ton above the equivalents of Eastern markets.

### Plates.

Plates have suffered with other products in the fluctuations of the year. The pool quotation of $35 a ton is still in effect, having been established in June, 1901, and continued uninterruptedly. It was reaffirmed at the meeting of manufacturers on Dec. 17. The decline in demand was first felt in June, when the steel car interests decreased their specifications. The situation was aggravated by numerous strikes in the building and allied trades during mid-summer months, and when in August steel car plants cut their specifications in two because of the large cancellations of orders for cars by railroads, mills were left with wide gaps in their order books which they could not fill. The extent of these cancellations may be estimated from the statement of one car company that whereas in August, 1902, it had orders on its books for 12,000 cars, in the same month of 1903 its contracts did not call for more than 200 cars. The market decline in demand for plates as compared with 1902 may also be judged from the fact that while mills this year have little or no tonnage booked for delivery in 1904, they had sold their capacity for the first six months of 1903 by Oct. 2, 1902. Premiums were paid for prompt deliveries last year, as high as $8 a ton above the base price, and jobbers asked $48 a ton on such business as fell to them through the inability of mills to deliver in the requisite time. The tonnage closed in the fall of 1902 for delivery in 1903 was taken at the regular price of $35 a ton, however, premiums not being heard of again until the following February, when a pressing demand was felt for prompt shipment due to the crowded condition of mills. In this market the premiums at

AVERAGE MONTHLY PRICES (IN DOLLARS) OF IRON AND STEEL PRODUCTS AT CHICAGO IN 1903.

*(All Gross Tons, except Bar Iron, Plates and Sheets.)*

| | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lake Super'r Char. Iron | $26.60 | 27.50 | 27 50 | 26.40 | 24.50 | 23.75 | 22.40 | 20.75 | 18.50 | 17.80 | 16.75 | 16.50 |
| North'n No. 2 Fdy | $25.00 | 24.00 | 24 00 | 23.00 | 21 70 | 20.50 | 18.50 | 17 50 | 16.85 | 15.90 | 14.50 | 14.30 |
| Southe'n No. 2 Fdy | $23 55 | 23.25 | 27.85 | 21.60 | 23.10 | 19 10 | 17 85 | 16.35 | 18.30 | 14 60 | 13.30 | 13.10 |
| Bar Iron | $35.20 | 36.2 | 38.00 | 36.00 | 35.25 | 34.25 | 33 60 | 30 25 | 30 75 | 29.30 | 27.75 | 26.00 |
| Rails | $28 00 | 28.00 | 28 00 | 28 00 | 28 00 | 28 00 | 28 00 | 28 00 | 28 00 | 28.00 | 28 00 | 28.00 |
| Tank Plates | $35 00 | 37 00 | 38 00 | 40 00 | 37.75 | 35.00 | 35 00 | 35 00 | 35.00 | 35 00 | 35 00 | 35 00 |
| Sheets No. 27 | $55.30 | 55.30 | 57.55 | 57 50 | 57.3 | 57 30 | 56.30 | 55 30 | 54.80 | 53.30 | 52.00 | 49.30 |
| Old Rails | $24.00 | 24 00 | 24.00 | 24 00 | 23.00 | 21.00 | 20 40 | 18.65 | 17 10 | 15 90 | 14.75 | 14.00 |
| Old Wheels | $23.00 | 23.50 | 23 50 | 23 50 | 22.00 | 20 00 | 19 60 | 18.25 | 17.10 | 16 00 | 14 85 | 11 50 |

no time exceeded $5 a ton, the average being $3, and were asked by all sellers. They had vanished entirely by June 1. The demand in the first quarter of the year grew to such proportions that the leading local interest was forced to withdraw from the market in February, having sold its capacity to November. From June, however, orders and specifications commenced falling off, and in October the plate mill at South Chicago was shut down for three weeks on account of lack of work. It was followed a month later by the Inland Steel Co. (manufacturing sheets and light plates), which kept its plant at Indiana Harbor, Ind., idle for the whole month of November. Business improved slightly in December, though not to any marked extent. GEO. H. GRIFFITHS.

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A merger of the Loomis-Pettibone Gas Machinery Co., 52 William street, New York, and the Holthoff Machinery Co., of Cudahy, a suburb of Milwaukee, Wis., has been completed and the Power & Mining Machinery Co. has been incorporated, with a capital of $2,500,000, for the purpose of carrying on the business of both concerns. The Loomis-Pettibone company manufactures gas producers and has taken some large contracts recently for equipment to be installed in the Velardena and other Mexican mines. The American rights for the manufacture and sale of the Crossley (British) gas engines are held by the same concern. The Holthoff company builds mining, smelting, also milling plants and machinery, and conducts an extensive export business, especially with Mexico. The directors of the Loomis-Pettibone Co., Benjamin Guggenheim, Cyrus Robinson, Hawley Pettibone and Leon P. Fuestman, together with H. C. Holthoff, vice president, and B. T. Leuzarder, secretary and treasurer of the Holthoff Machinery Co., will be directors of the newly incorporated concern. The officers will be: Benjamin Guggenheim, president; Cyrus Robinson, H. C. Holthoff and B. T. Leuzarder, vice presidents; Leon P. Feustman, treasurer, and Hawley Pettibone, consulting engineer. The construction of the large plant, which the Loomis-Pettibone Company proposed to build in Elizabeth, N. J., is postponed for the present and the Loomis-Pettibone and Holthoff specialties will be built at the Holthoff plant at Cudahy, Wis., which will be considerably enlarged.

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The Washington Pipe & Foundry Co., Tacoma, Wash., has purchased the plant of the Deming-Berry Pulley Co. and will enlarge the works and install considerable new machinery.

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The American Locomotive Co. has declared the regular quarterly dividend on its preferred stock, payable Jan. 21.

## IRON MARKET FLUCTUATIONS IN 1903.

In a supplement accompanying this issue we present a chart showing the fluctuations in monthly average prices of certain iron and steel products through the year 1903 and in the eight years preceding. The figures on which the chart is based are the averages of weekly prices given in the market reports of *The Iron Trade Review*. These are computed for Bessemer pig iron at Pittsburg, Northern No. 2 foundry iron at Chicago and gray forge at Cincinnati, for Bessemer steel billets at Pittsburg, and for three forms of finished material—beams at Pittsburg, tank plates at Chicago and bar iron at Cleveland.

The vertical lines in the chart represent months and the horizontal lines prices per ton in dollars. The solid and broken lines that traverse the diagram indicate the changes in monthly average prices, but do not show the highest or lowest price that may have been reached in some week of the month. In the plotting of the price lines for 1902 the prices paid for prompt material, which were considerably higher than the concurrent prices for forward deliveries, were taken as the basis. This gave a noticeable variation in plates and beams, which were pool controlled, from the prices maintained by the associations throughout the year. In 1903 it will be noticed that the price for structural material is the uniform one maintained by agreement, little having been sold, except by jobbers, at higher figures. In the case of plates slight premiums were paid in some of the early months of the year, but the association price was unvarying. The table of monthly averages, from which the lines for 1902 were plotted is as follows:

AVERAGE MONTHLY PRICES OF IRON AND STEEL PRODUCTS IN 1903.

| | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. 2. Fdy Chicago..... | $25.00 | 24.00 | 24.00 | 23.00 | 21.70 | 20.50 | 18.70 | 17.50 | 16.85 | 15.90 | 14.50 | 14.30 |
| Gray Forge Cincinnati .. | $20.50 | 20.75 | 19.35 | 19.20 | 17.70 | 16.50 | 14.60 | 13.50 | 13.25 | 12.30 | 10.95 | 10.75 |
| Plates, Chicago ..... | $35.00 | 37.00 | 38.00 | 40.00 | 37.75 | 37.00 | 35.00 | 35.00 | 35.00 | 35.0 | 35.00 | 5.00 |
| Billets (Bess) Pittsburg | $29.75 | 30.00 | 30.25 | 31.00 | 30.50 | 9.50 | 27.50 | 27.00 | 27.00 | 26.50 | 23.50 | 23.00 |
| Bessem'r Pig Pittsburg .. | $22.35 | 22.35 | 22.00 | 21.60 | 20.00 | 19.85 | 19.00 | 17.85 | 16 35 | 15.85 | 15.25 | 14.35 |
| Beams Pittsburg ..... | $32.00 | 32.00 | 32.00 | 32.00 | 32.00 | 32.00 | 32.00 | 32.00 | 32.00 | 32.00 | 32.00 | 32.00 |
| Bar Iron, Cleveland .. | $35.00 | 37.00 | 37.00 | 38.00 | 35.00 | 33.75 | 33.00 | 30.00 | 29 00 | 28.00 | 28.00 | 25.50 |

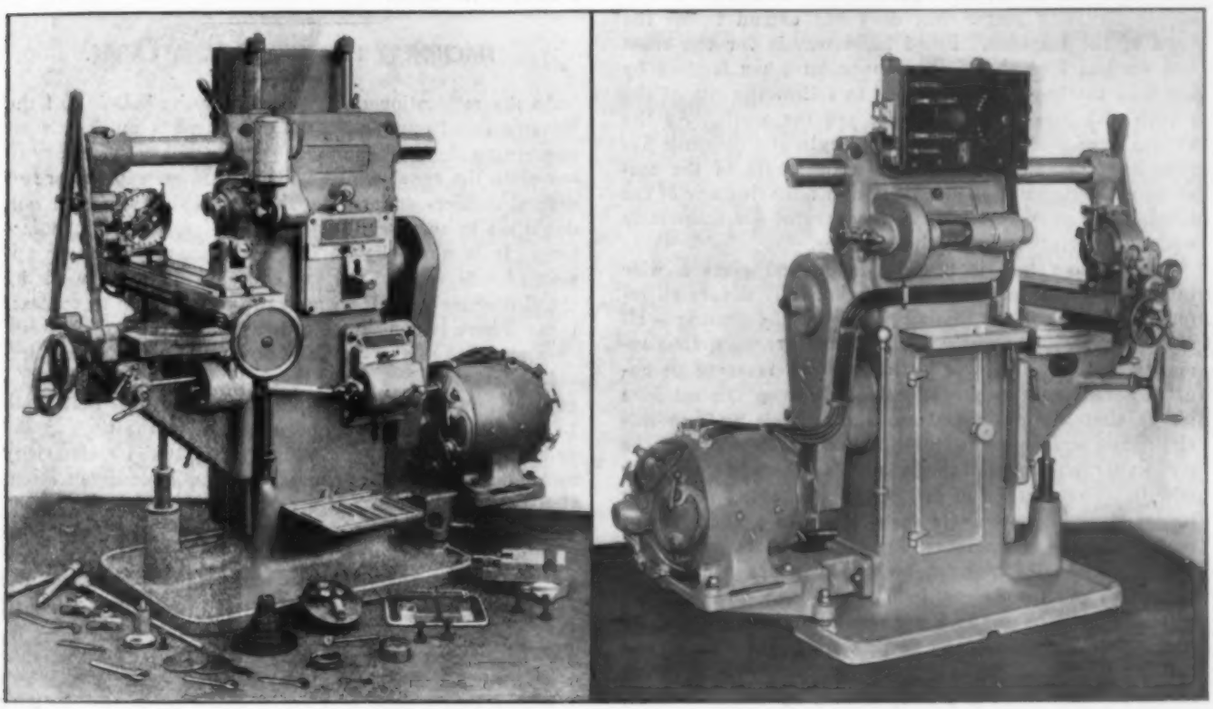
High wind on Dec. 14 caused the collapse of the east wall of the Gould steel plant, Depew, N. Y. A strip of about 60 feet in length and 50 feet in height went down.

## Universal Milling Machine With Constant Speed Motor Drive.

The Brown & Sharpe Mfg. Co., of Providence, R. I., has a new design of milling machine which is shown in the two accompanying views. It has some features which have not been incorporated heretofore in a machine of this character. The fact that the main driving shaft runs at a constant speed illustrates how well this machine is fitted for the application of the motor drive, as it permits the use of any standard type of constant speed motor and also ensures the full efficiency of the motor being at all times available.

The table has an automatic longitudinal feed of 23 inches, an automatic traverse feed of 7½ inches, and can be lowered 17½ inches from the center of the spindle. The centers swing 10 inches in diameter and take 19½ inches in length.

The spindle is of crucible steel with large bearings that are ground and lapped and run in phosphor bronze boxes provided with means of compensation for wear. The variable spindle speed is obtained by gearing having a ratio varying from zero to 20 to 1. The variations of spindle speeds are controlled by the simple movement of a lever and index slide on the side of the machine. The plate over the index slide gives the various spindle speeds and the position of the levers to obtain them.



NEW MILLING MACHINE WITH CONSTANT SPEED MOTOR.

This drive overcomes the well-known objections of the cone drive and enables the spindle to be efficiently driven under all conditions. It provides for the use of the same size pulley on both the counter-shaft and machine, thus giving a much greater belt contact and driving leverage than can be obtained with the usual cone drive.

The back gears are thrown in and out by a lever in the usual way; the locking-pins that engage the spindle sleeve, which replaces the cone head, are operated automatically by the movement of the lever.

The overhanging arm is a solid steel bar that can be pushed back from over the table when not in use. This form of arm makes it possible to place any of the regular attachments in position without the necessity of either removing or reversing it. The arm is simply and efficiently clamped at both bearings by one lever at the front of the machine, thus enabling the operator to make adjustments quickly.

The table is heavy in proportion to the capacity of the machine and the T slots are sufficiently deep to insure strength. The angle at which the table can be set for automatically cutting spirals is unusually large and gives an exceptionally wide range. It has a quick return that is operated from the right hand end of the table by an internal gear and pinion, which gives ample leverage to secure ease of manipulation. Suitable oil pans and channels are provided.

The feed screw is not splined, an auxiliary shaft being provided for driving the clutch gears and, as the threads are thus left unbroken, the life of the screw and nut is greatly prolonged and the accuracy maintained.

The saddle, which carries the table, pivots in the clamp bed and can be rigidly clamped to it by bolts that slide in circular slots and allow the table to be swiveled to bring either side next to the face of the column; this feature is convenient for special work, as it avoids the necessity of resetting. It is graduated to read to 90° either side of zero; the graduations reading to half degrees. The saddle is heavy and the table bearings long and wide, insuring rigidity and correct alignment.

The knee is of box form and has large bearing surfaces and has a vertical adjustment by means of a telescopic elevating screw that does not extend below the base of the machine. Fixed hand wheels for the cross and vertical feed shafts are convenient when feeding by hand, as the operator is enabled to follow the rim of the wheel with his hand and easily see the work. As the vertical feed shaft is placed at an angle, the operator has complete control of the various movements of the machine without changing his position or removing any of the handles and any two feeds can be operated simultaneously without interfering one with the other.

The variable feed is new in design and gives a wide range in geometrical progression, that fully covers all requirements of modern milling practice. The gearing is all spur gears, with properly proportioned bearings, thus reducing the loss of power by friction and insuring an unusually high efficiency. The drive is from the machine pulley shaft by chain and sprocket wheels and, as this shaft runs at a constant speed, it is possible to obtain the correct feeds in relation to the spindle speeds in inches per minute. This method of driving gives a table feed that is independent of the spindle speed and also a fixed rate of feed, in inches per minute, for all diameters of cutters.

The feed varies from ½ inch to 6 inches per minute, giving for small mills, .001 inch to .016 inch, and for large mills, .003 inch to .400 inch per revolution of spindle. The feed changes are easily and quickly obtained by the simple movement of a lever and index slide. The position of the levers for each feed is plainly shown by the feed table. All levers for controlling the various feeds are conveniently located at the right of the knee to insure ease and quickness of manipulation.

The feed tripping mechanism is of the double plunger type and unusually sensitive. It can be set to prevent throwing in of the wrong clutch, and when the feed is tripped, it is not necessary to run the table dog beyond the trip plunger to reverse the feed, the simple reversing of the tripping lever being all that is required.

All graduations are engine divided. Adjustable dials graduated to read to thousandths of an inch indicate the longitudinal, transverse and vertical movements of table; and a series of graduations, reading to half degrees, show the angle to the axis of the spindle at which the table is set. The dials may be adjusted without the aid of wrench or screw driver.

The spiral head is exceptionally rigid as it turns upon its base in a manner that permits the full width of the head to be used as a bearing and gives unusually long and wide bearing surfaces. When operated automatically in conjunction with the movement of table, the velocity of the rotary motion of its spindle, or of the work, relative to that of the table feed-screw, is regulated by change gears at the end of the table and allows spirals of almost any desired lead to be cut.

A plate for rapid indexing of the work is placed directly on the spindle and can be used with the head set at any angle. When rapid or plain indexing is desired, the worm that turns the spindle is thrown quickly out of gear by means of a knurled knob on the back of the spiral head.

The front end of the spindle may be elevated to any desired angle with the table between 10 degrees below the horizontal and 5 degrees beyond the perpendicular and rigidly clamped at any point. The side of the spiral head is graduated to half degrees to show the angle of elevation. By means of the raising block the head can be set at any angle on the table. The printed table furnished with the machine gives an improved method of indexing, patented November 12, 1901, that is much simpler than the compound indexing method heretofore employed, no more care being required than is necessary in plain indexing.

The index sector is graduated to enable the arms to be quickly set without the necessity of counting the number of holes required in any given circle. The setting is taken directly from the index table. The index crank is adjustable. This feature is found very convenient for delicate adjustments of the work and enables the index crank pin to be brought to the nearest hole without disturbing the setting of the work.

## MACHINERY FOR THE PANAMA CANAL.

As the ratification of the treaty for the building of the Panama canal now seems assured, there is much interest concerning the new equipment which will be necessary to complete the canal which will demand an expenditure of several million dollars' worth of machinery, which will doubtless be to a very large extent of American manufacture. It is not believed that the commission to be appointed will recommend the completion of the work by the Government itself without the intervention of contractors. There is considerable doubt as to the value of machinery on the isthmus. It is understood that a considerable part of it has never been taken from the original packing. Much of the equipment was the best that could be purchased in the European market at the time it was ordered, including the machinery operated by electricity and compressed air. Contractors who have given attention to the matter are as a rule of the opinion that much of the machinery must be regarded as valueless. This opinion is in consonance with that of the Panama commission, who investigated the entire canal project for the Government. In their report on the machinery on hand they said:

"There is on hand an immense amount of plant, consisting of locomotives, excavators, dredges, cars, rails and machine implements and tools, spare parts and supplies of various kinds, besides buildings used for offices, quarters, storehouses, hospitals, and miscellaneous purposes, and some 30,000 acres of land.

"As a general rule this property shows signs of attention and evidence seems satisfactory that it has been well cared for since the liquidator took charge in 1889. It would manifestly be improvident, however, to fix a value upon any important machine which has been idle that length of time without first actually testing it at work, however neatly painted and sheltered it may now be. Much of the property is ill-adapted to American methods and all of it is now from 13 to 20 years old, during which period the improvements in this class of machinery have been such that contractors would generally find it to their advantage to buy entirely new machinery of modern pattern rather than attempt to use this older class, even if given to them free in good order.

"The locomotives, rails and cars may be of some service, but their value is doubtful; the locomotives are much lighter than is desirable for economical service, the rails are of a pattern ill-fitted to rough use and the cars have narrow-tread wheels. These are probably the best part of the whole outfit.

"It has seemed to the commission that in acquiring the Panama canal the United States should not buy this plant as a whole and that no special allowance should be made for it in estimating the total value of the property."

# INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

**New Buyers in the Market and Some of Their Wants:—**

The J. W. Cregar Agency, machinery, tools, special equipments, the Bourse, Philadelphia, has an inquiry from a Mexican company for a large amount of new machinery, including blowers for two smelting furnaces; seamless steel pipe, one-eighth to one-quarter-inch wall, two inches to four inches diameter; iron pipe, all sizes; five tons of wire nails, all sizes; also 25 tons of iron rods, all sizes, and turnbuckles for same; ton drill steel, all sizes; iron washers, all sizes; silent chain for motor drive; road-making machines; two 35 to 50-h. p. traction engines; 250-h. p. water turbine and generator, 220-volt direct current. The Cregar Agency has also been made purchasing agent for the Limon and Agricola mines, near Jalapa, Nicaragua, Central America, and would be glad to have manufacturers send their catalogues and export-trade prices on everything used in mines and sold in mining companies' stores.

The Valentine Gas Engine Co., Westfield, N. J., recently incorporated, requests catalogues from makers and dealers in supplies.

The Standard Sand & Machine Co., Cleveland, capital $40,000, has been incorporated by H. G. Boughton, J. A. Boughton, Harry E. Boughton and Thomas J. Morgan.

F. Toler Jones, Box 565, Charleston, S. C., is in market for second-hand hoisting engine, also stationary engine.

Columbia Machine & Iron Works, Columbia, S. C., want to correspond with boiler makers.

Warren Wagner, Beaumont, Tex., wants prices on machinery for drilling oil wells, including engines, boilers, pipe of all sizes, etc.

J. M. Grossius Furnace Co., Cincinnati, has been incorporated with a capital of $50,000. Incorporators are: V. H. Grossius, W. Grossius, F. W. Barry, Guy W. Mallon, N. J. Danahal and W. J. Foy.

The St. Louis Wire & Iron Co., St. Louis, Mo., has been incorporated with a capital of $7,000 to manufacture, repair and deal in wire and iron. Incorporators are: Reinhold Tiesler, Ferdinand P. Laclerq and Eugene E. Scmitt.

The Daniel Russell Boiler Works, incorporated, Boston, Mass., capital $10,000, have been incorporated to manufacture and deal in steam and other boilers, engines, etc. The officers are: President, John J. Regan; treasurer, Daniel Russell, Boston; clerk, James M. Hooper, Lynn, Mass.

John W. Shinholser, E. P. Willingham and others, Macon, Ga., have incorporated Shinholser & Co. with capital of $25,000 for manufacturing and dealing in agricultural implements.

The Carolina Coupler Co., Asheville, N. C., has been incorporated with a capital of $50,000 to manufacture couplers of all kinds.

The Attwood Chain Works, Lebanon, Pa., have been incorporated with a capital of $100,000. The following officers have been elected: Eli Attwood, president and general manager; Walter Barston, of Brooklyn, vice president, and George Holly, secretary and treasurer. Mr. Attwood has completed negotiations for securing the present plant of the Lebanon Chain Works for the new company.

Articles of association have been filed by the Bryant-Hill Co., Detroit, with a capital stock of $8,000. The company will engage in the manufacturing and dealing in all kinds of patterns and machinery.

The Snyder Heater Co., Detroit, has filed articles of association. The company will engage in the manufacture of mill supplies, etc. Capital stock is $20,000. The stockholders are: Etta Snyder, Charles H. Snyder, of Detroit, and Elmer Chisholm, of Jackson.

The Wade Iron Sanitary Mfg. Co., Chicago, capital $2,500, has been incorporated to manufacture plumbing and sewerage supplies. The incorporators are: Edward T. Wade, Daniel V. Harkin and D. Herman Berger.

The National Engine Co., Buffalo, has been incorporated with a capital of $40,000. Directors are: G. C. McDonald, M. W. Kribbs and G. M. Kellogg, Buffalo.

**Fires and Accidents:—**

The plant of the R. C. Wooley Co., Cincinnati, manufacturer of machines and pipe fitters' supplies, was damaged by fire Dec. 22. Loss, $10,000.

Fire recently destroyed the pattern shop and foundry of Miner Seating Co., Canal Dover, O. Loss, $16,000; insurance, $8,000.

The National Tube Co.'s plant at Owen Sound, Ont., was destroyed by fire on Dec. 25. Loss, $60,000.

Fire of unknown origin partially destroyed the foundry of the Aultman & Taylor Co., Mansfield, O. Loss, $10,000, covered by insurance.

The plant of the Lancaster Malleable Iron Works, Lancaster, N. Y., was destroyed by fire Dec. 21. Loss, $8,000, covered by insurance.

An early morning fire, Dec. 19, damaged the buildings and plant of the Stephens & Westcott Co., Chicago, manufacturer of agricultural iron. Damage $50,000.

Fire destroyed the machine and blacksmith shop of S. P. Knapp, Farmer City, Ill., Dec. 13. Loss $6,000, with $2,000 insurance.

**New Construction:—**

The Waterloo Motor Works, Waterloo, Ia., did not own the building which was recently destroyed by fire, as it was rented from the Cascaden Mfg. Co., but the company has another well equipped plant in operation, and as the patterns were not lost it will continue to make both the Davis and Waterloo engines as manufactured by its predecessors in business. The company last week finished the roof on its new plant, which will be ready for occupany in about 60 days. The new plant will consist of a concrete stone main building, 100 x 300, and a foundry building, 60 x 120 feet. These are built according to the best designs of factory construction.

The South Bend Foundry Co., South Bend, Ind., gave a shop-warming a few evenings since for its employes, the occasion being the dedication of the company's new foundry. The main building is 302 x 60 feet. The company manufactures the Perfection chilled plow and does general foundry work.

The United States Cast Iron Pipe & Foundry Co. will make improvements at its plant at Anniston, Ala., which will greatly increase its capacity.

The directors of the Henderson Car Works have selected a 21-acre tract between Seventh and Ninth streets, Henderson, Ky., as the location for the plant. There will be 11 buildings in all, including the finishing building, 190 x 600 feet; wood mill and cabinet and varnish rooms, 200 x 336 feet; the track, machinery and blacksmith shops, 150 x 224 feet, and the power house, 120 x 50. The plans will be finished by Jan. 15 for the erection of the buildings.

During January the Rock Island railroad will open its shops at Moline, Ill. They will be the largest railway shops owned by any railway company west of the Mississippi, and were erected and equipped at a total cost of $1,750,000. The appropriation was made last February, the site was agreed upon and paid for in April and active work was commenced early in May. Had it not been for delays in receiving structural steel and machinery, the shops would have been ready for use six weeks ago. The rapidity with which the construction has been completed has elicited much favorable comment.

Work will soon begin on the addition to the forging plant for the Midvale Steel Co., Philadelphia, to cost $20,000.

The Brandon Machine Works Co. will build a new foundry at Brandon, Ont.

The Eagle Mfg. Co., Appleton, Wis., has made arrangements to build a new plant early in the spring. The buildings will be: main building, 323 x 40 feet; foundry,

148 x 40 feet; wood working room, 70 x 40 feet, and warehouse, 160 x 36 feet. The company manufactures gasoline engines.

The Tampa Steam Ways Co., Tampa, Fla., will rebuild its shipbuilding and repairing plant, recently burned, expecting to expend about $50,000. The new structures will include main building, 94 x 47 feet; engine house, 36 x 22; blacksmith shop, 74 x 40 feet, and machine shop, 74 x 50 feet.

About $300,000 is to be expended on the construction and equipment of shops and foundry at Hornos, located in the municipality of Viesca, state of Coahuila, Mexico. Claudio J. Martinez, of that place, is primarily interested in the project.

The J. M. Brant Co., Bushnell, Ill., recently incorporated, expects to erect a building in the spring. It does not intend to manufacture at the present time. The company rebuilds engines and separators, and handles all kinds of heavy machinery.

The plant of F. E. Came, Montreal, recently destroyed by fire, is being rebuilt and will be in operation in part this week. Another building, rented for temporary purposes, is being utilized to fill pressing orders. The new shop will be 400 x 80 feet.

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**General Industrial Notes:—**

The Milwaukee Steel Foundry Co., Milwaukee, Wis., recently incorporated, has leased the Rundle & Spence foundry at South Water and Virginia streets, and is equipping it with the latest improved machinery for making a specialty of small steel castings from ¼ pound to 500 pounds. It is installing the converter process which will enable it to make all grades of steel, including electrical steel, which will be very low in carbon, machinery steel, tool steel and manganese steel. The company expects to be in operation about the middle of January.

The Tompkins Bros. Co., Troy., N. Y., recently incorporated, has taken over the plant of Tompkins Bros., and will continue to operate it, gradually increasing its capacity and equipment, but not building, as there is plenty of room. The business is that of manufacturing knitting machinery.

The Badger Machinery Co., Milwaukee, Wis., recently incorporated, will do a general jobbing business in power transmission appliances. Capital stock is $25,000, with 50 percent thereof paid in. D. M. Guibert, the vice president, and C. A. Schuman, secretary, were formerly connected with the Milwaukee-Rice Machinery Co.

The Columbus Iron & Steel Co., Columbus, O., has increased its capital stock from $750,000 to $1,000,000.

The Beloit Iron Works, Beloit, Wis., recently were awarded a large contract for equipment for a British paper mill owned by Chicago interests and known as the Thames Paper Mills, located near London.

The Phillips Pressed Steel Co., Joliet, Ill., has increased its capital from $25,000 to $50,000.

It is expected that the South Sharon plant of the American Steel & Wire Co. will resume operations between Jan. 1 and Feb. 1, giving employment to 3,000 men.

Furnace No. 3 of the Republic Iron & Steel Co., at Thomas, Ala., has been closed down for an indefinite period. Furnace No. 1 is being rapidly overhauled and will be put in service in a comparatively short time. No. 3 will be given a thorough overhauling.

The largest engine which will be seen at the St. Louis exposition was shipped from the West Allis plant of the Allis-Chalmers Co. a few days ago. It has 5,000 h. p. and 21 freight cars were required to carry it. The company at one of its Chicago plants is preparing a carload of machinery which will be shipped to Siberia this week. Last week three cars of machinery were shipped to Johannesburg, South Africa, for mining operations. An order for machinery has also been received from the United States of Colombia.

H. S. Tremper has purchased a half interest in the Pioneer Iron Works, Olympia, Wash., and has taken active management of the affairs of the company. It is intended to enlarge the plant in the spring.

The Anderson, Ind., plant of the American Steel & Wire Co. will be put in operation shortly after the first of the year. When in full operation the capacity of the plant will be exactly double what it was a year ago. Extensive improvements have been made during the last eight months.

The Board of Estimate, of Brooklyn, N. Y., has decided to abandon Bowne street between Columbia and Richards streets at the request of the J. H. Williams & Co., which stated it would either have to extend its plant or move to some other city, as it was unable to get along with its present facilities.

The first bars ever turned out at Fort Wayne, Ind., were rolled Dec. 18 by the Fort Wayne Iron & Steel Co. at its new plant.

The iron mill department of the Colorado Fuel & Iron Co. has resumed operations, and it is announced that the rod and nail mill will resume in a few days.

Rene Heritage and W. J. Wooley have become the owners of the interest of George Healley in the Wooley Foundry & Machine Works, Anderson, Ind. The company manufactures gas engines and has been very prosperous. The reorganized company will still further push the business.

The usual semi-annual bonus distribution took place Christmas at the plant of the Remington Typewriter Co., Ilion, N. Y. About $13,000 in gold was distributed among 260 employes, of whom three have been in the service of the company 30 years, six 25 years, twenty-one 20 years, fifty-six 15 years, and one hundred and seventy-four 10 years.

The Morgan Engineering Co., Alliance, O., has brought suit against the Wellman-Seaver-Morgan Engineering Co., Cleveland, for an injunction against the use of the name "Morgan" in the corporate name of the latter.

The property of the Eastern Tube Co., Zanesville, O., has been appraised at $160,000, and Feb. 10, 1904, has been fixed for the date of the sale of the property in bankruptcy proceedings. The company was capitalized at $1,000,000 and has issued $175,000 common and $250,000 treasury stock.

Walter L. Stebbings, on trial for manslaughter, in connection with the death of Walter A. Scott, formerly president of the Illinois Wire Co., Chicago, was declared not guilty by the jury in Chicago, Dec. 24. The two men were office neighbors and had been on good terms until a disagreement arose over some plans for a wire mill. The trouble resulted in Scott's death, which occurred Aug. 9, 1902. The defense was that Stebbings accidentally killed Scott during a quarrel.

Judge Johnson, of the Delaware county court at Media, Pa., was granted a rule to show cause why a receiver should not be appointed for the Tidewater Steel Co., Chester, Pa. The company was organized in 1899 and has an authorized capital of $2,100,000. The works occupy about 30 acres in Chester and 500 men are employed.

A mortgage for $281,200, covering the plants of the Universal Caster & Foundry Co. in favor of the Fidelity Trust Co., of Newark, N. J., has been filed. This indicates the completion of the consolidation of John Toler, Sons & Co. and two other manufacturers of furniture casters. The Toler shops in Newark have been extended since the combination has been assured, and the New York and Brooklyn concerns will remove to Newark early next year.

The receivers of the Southern Car & Foundry Co. have made a report to the creditors. The sale value of all shipments during the receivership has been $544,163. There are on hand unfilled orders for 500 cars and the total value of unfilled orders is $330,480. The bank balance is $432,571.

The McGregor Automatic Boiler Feed Co., Detroit, recently incorporated, is, for the present, having its machines put up under contract, but hopes, in the near future, to be able to build a plant of its own.

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# THE IRON TRADE REVIEW

**A Weekly Journal Devoted to the Machinery, Metal-Working and Foundry Trades, and Iron and Steel Manufacture.**

VOLUME XXXVI | CLEVELAND, OHIO, DECEMBER 31, 1903 | NUMBER 53

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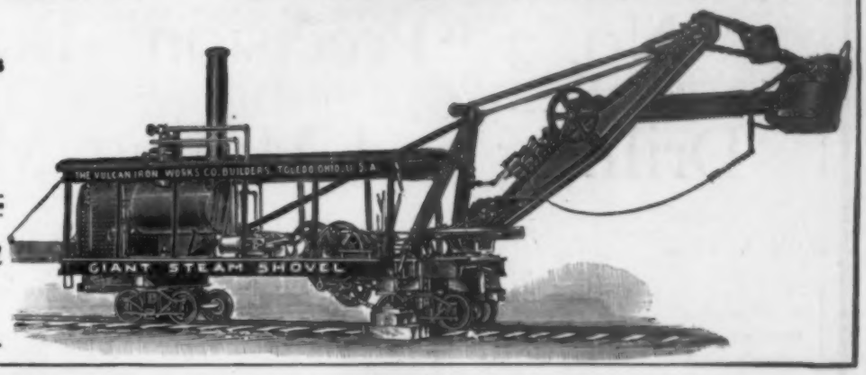


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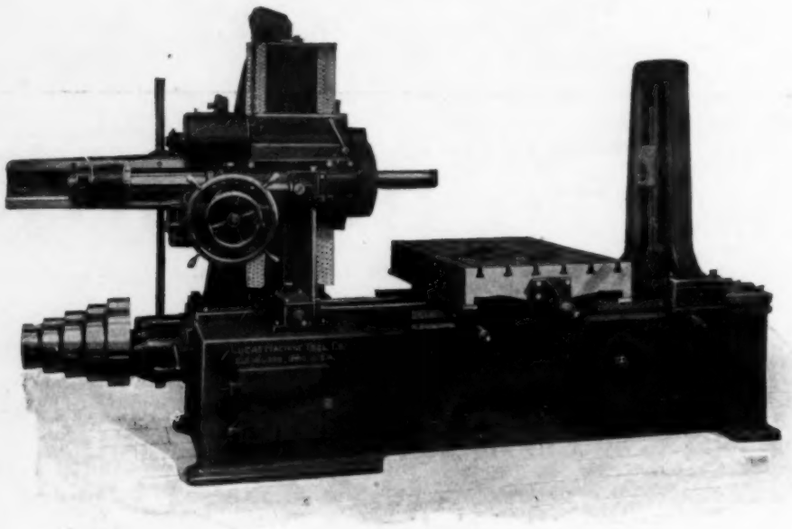

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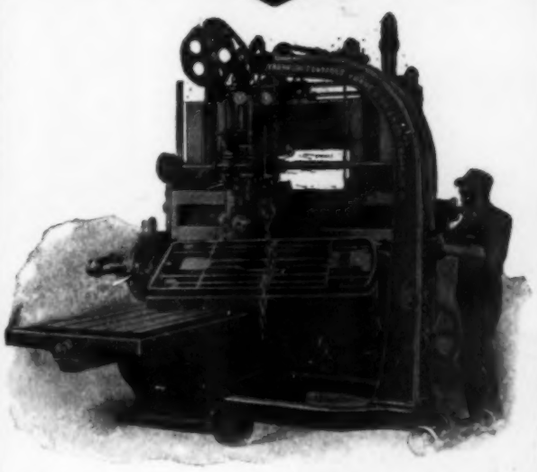

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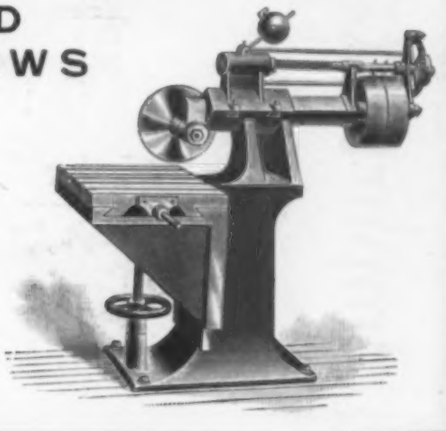

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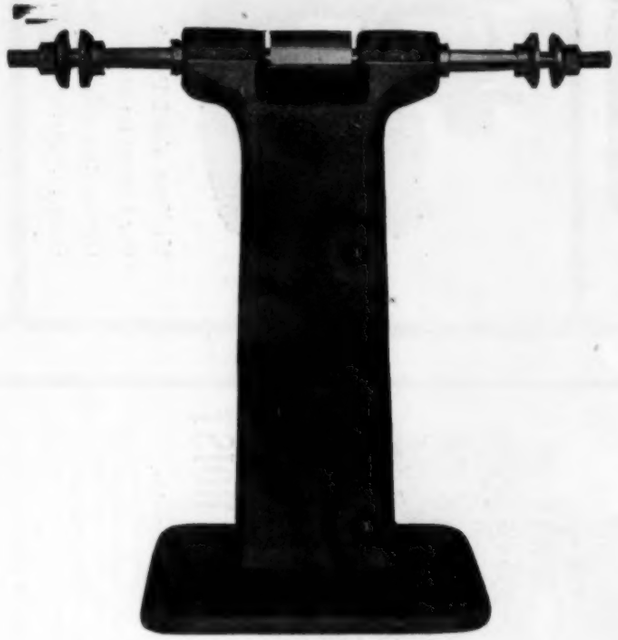

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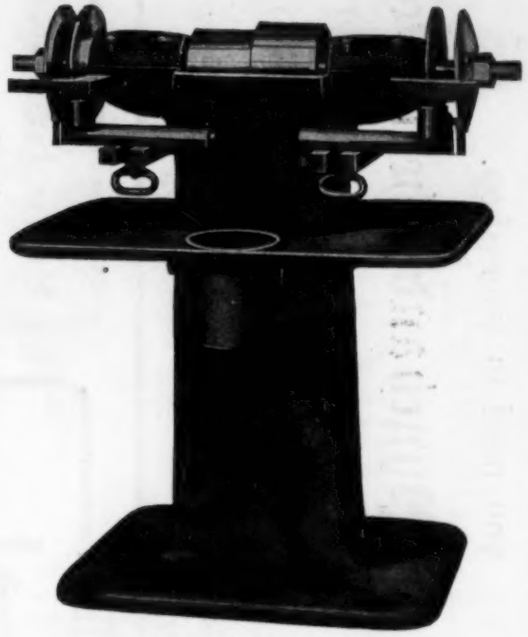

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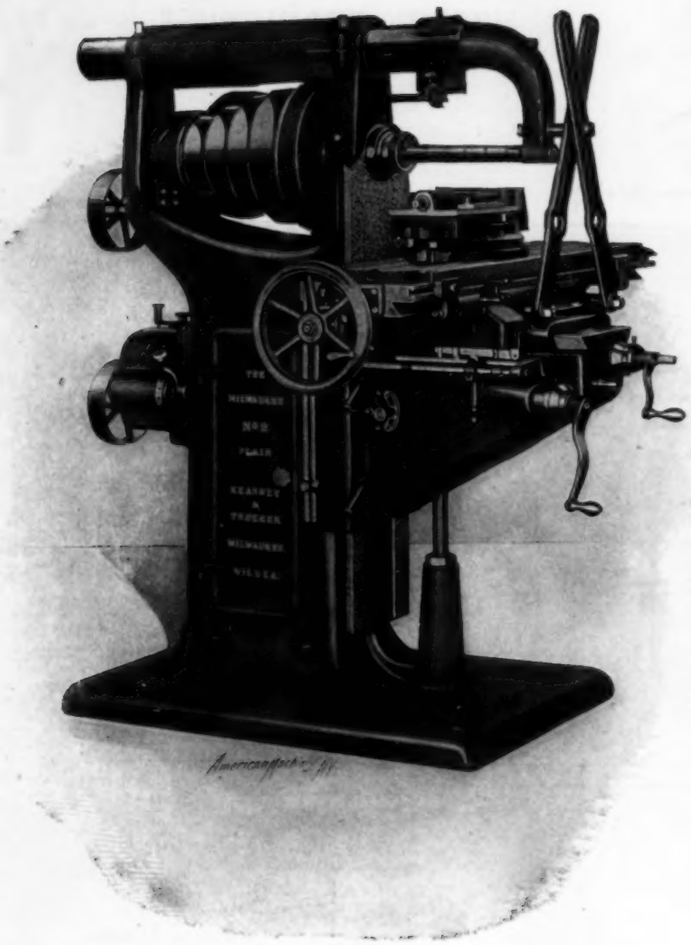

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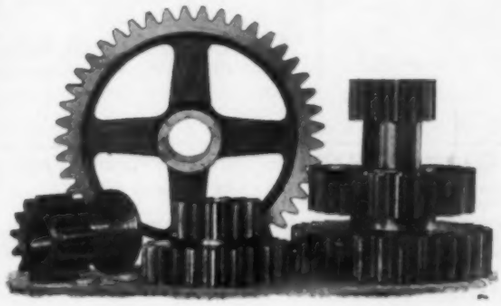

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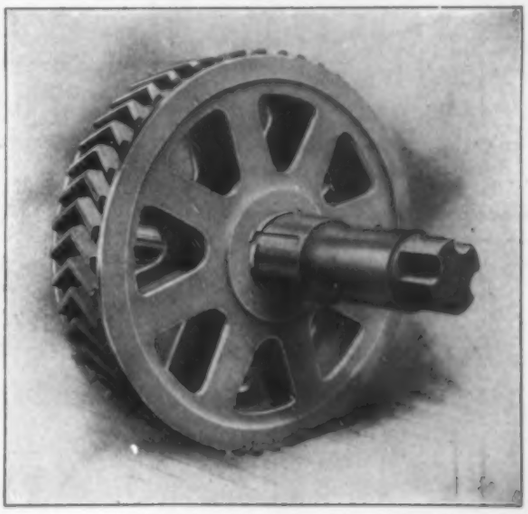

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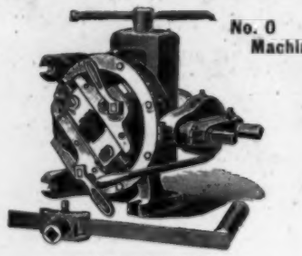

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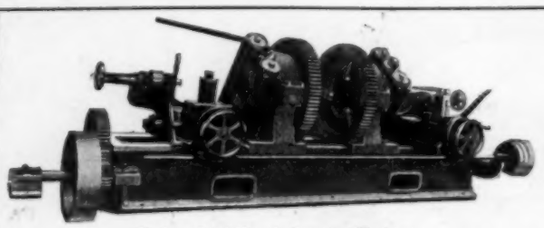

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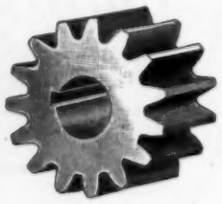

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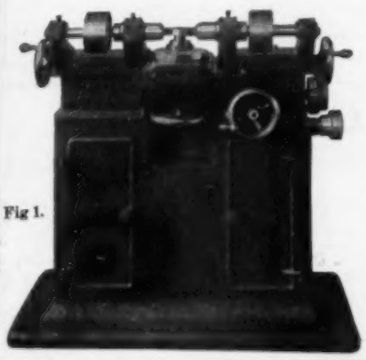

Fig 1.

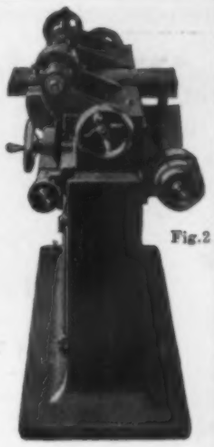

Fig. 2

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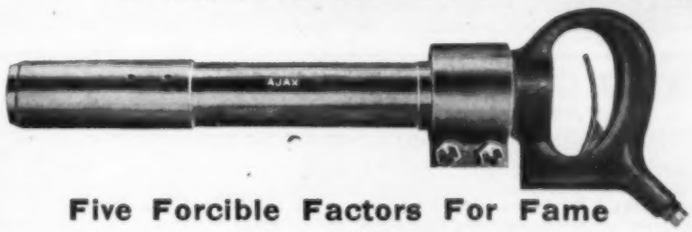


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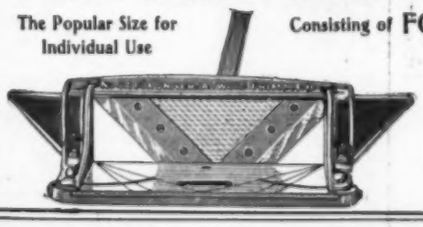

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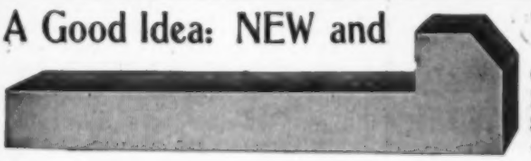

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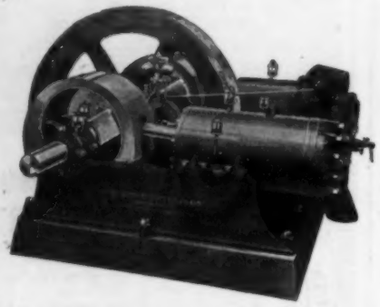

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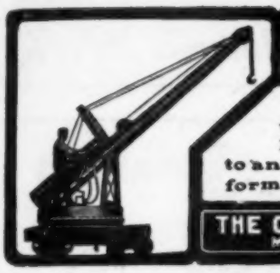

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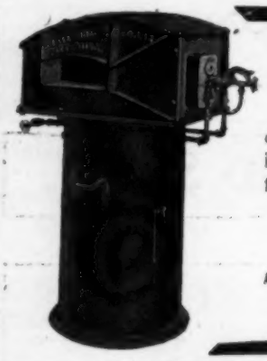

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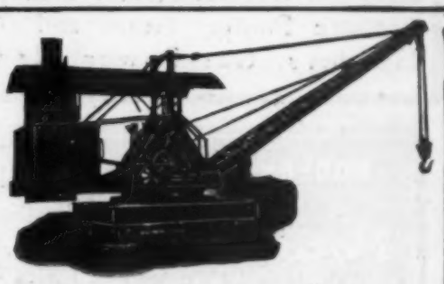

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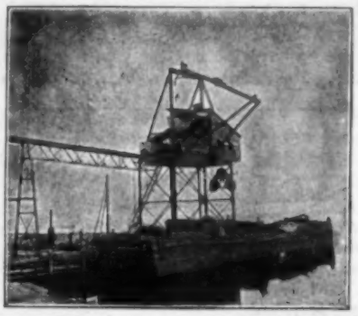

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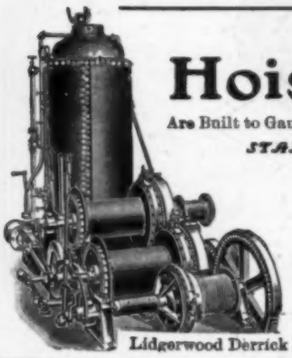

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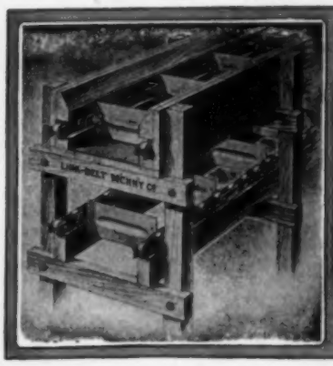

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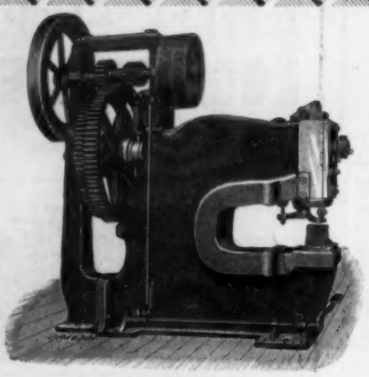

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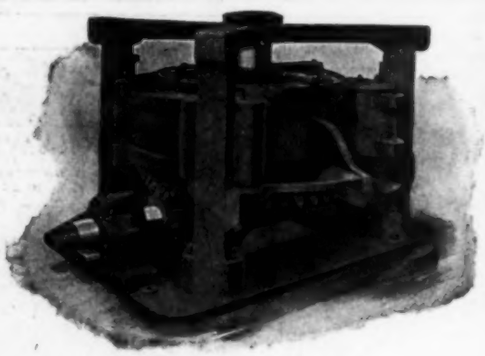

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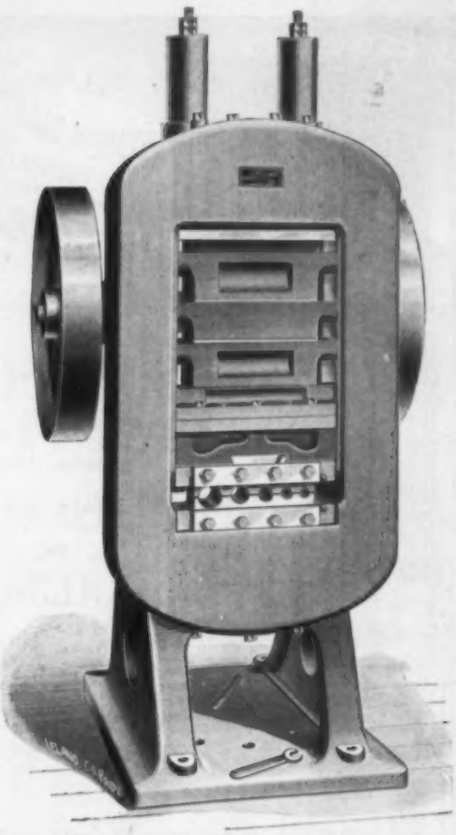

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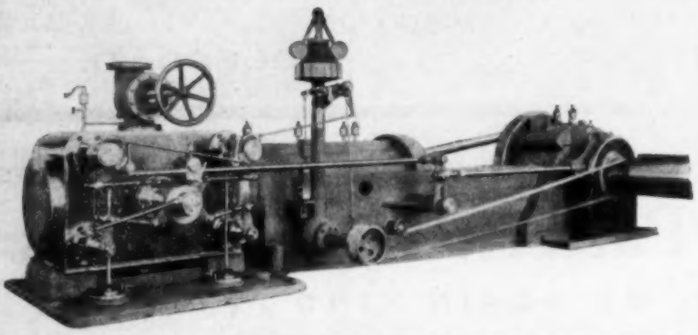

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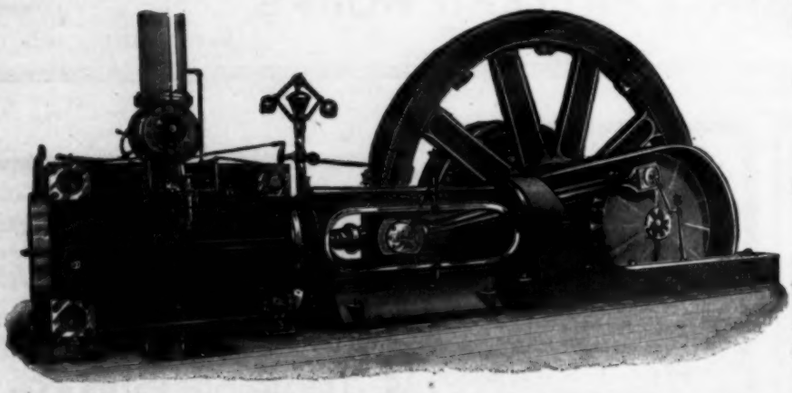

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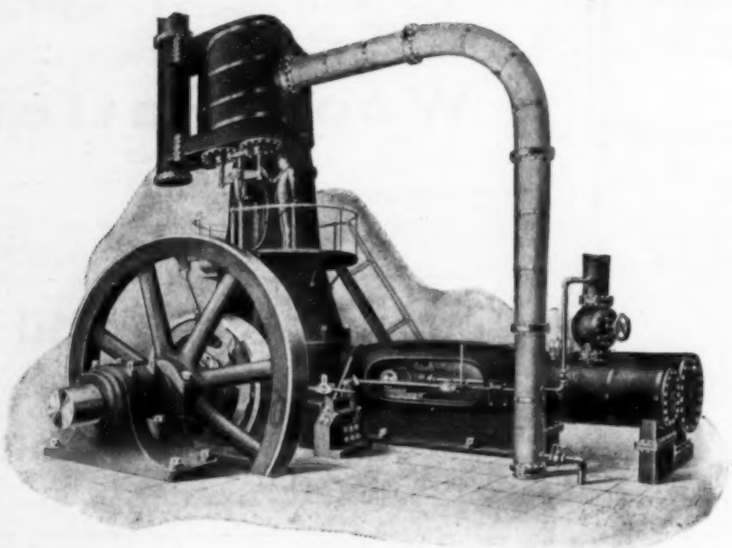

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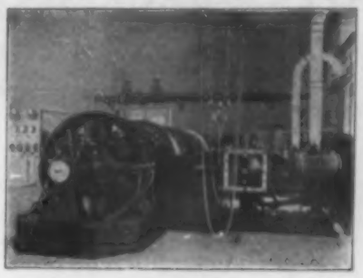

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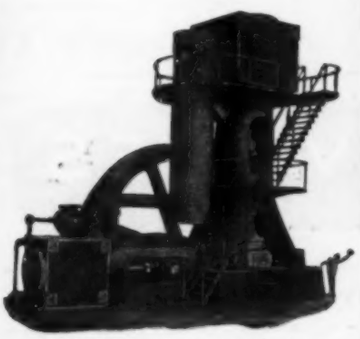

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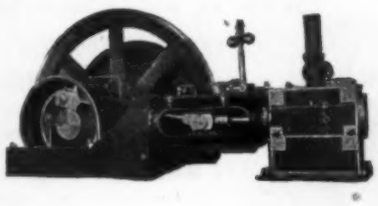

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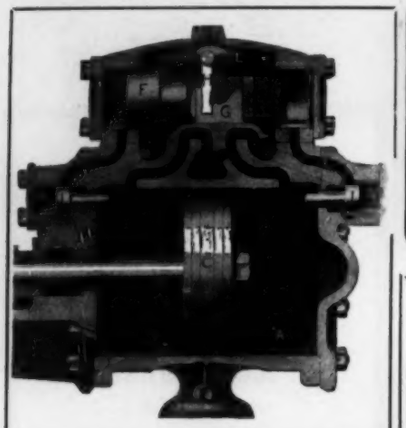

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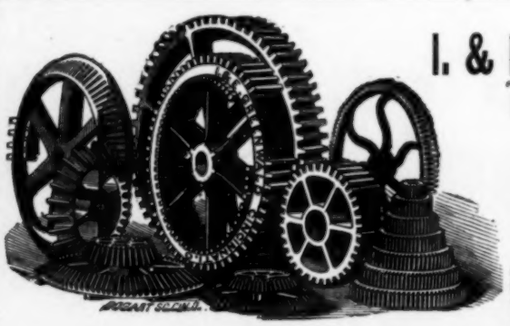

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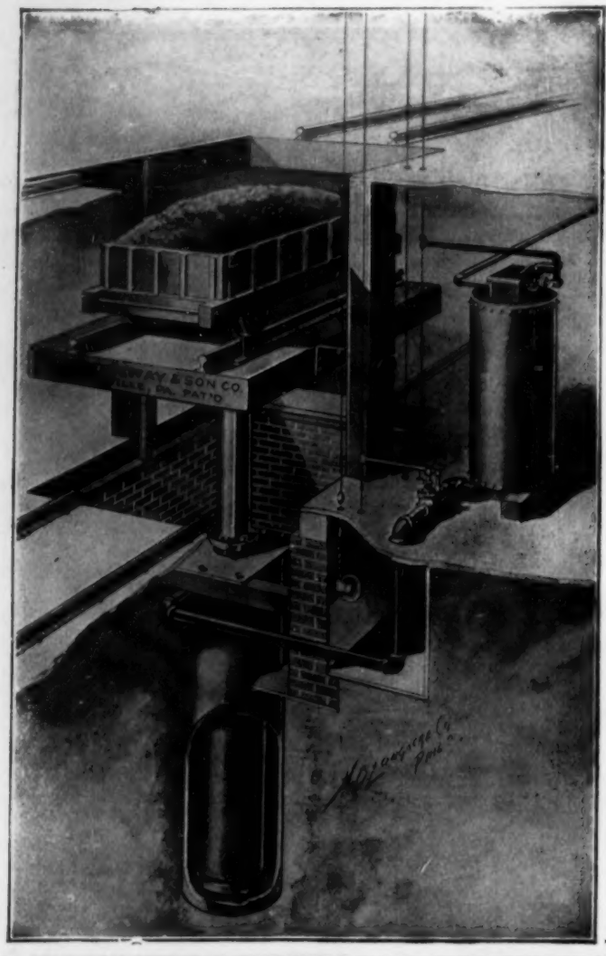

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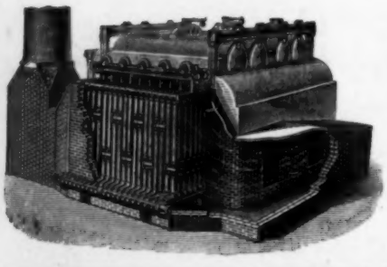

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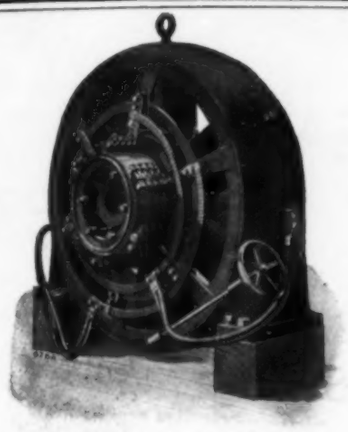

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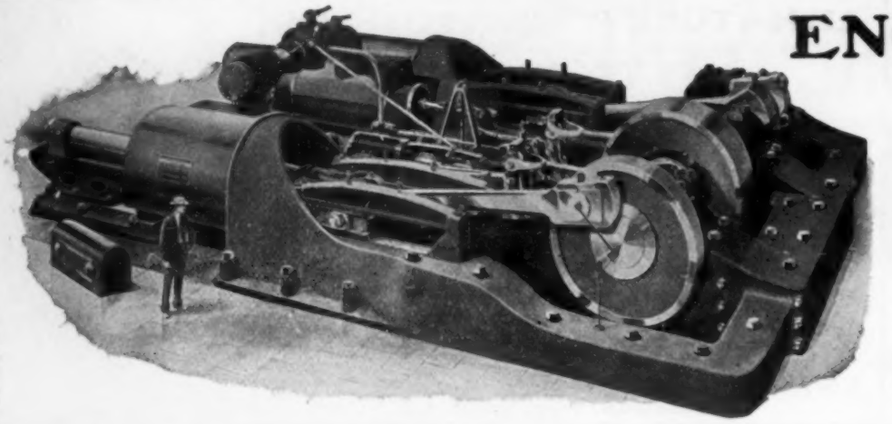

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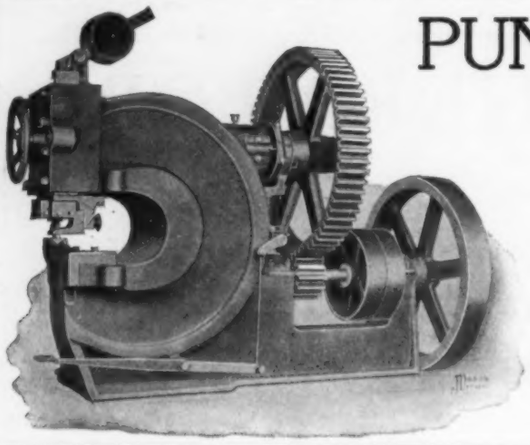

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Manufacturers also of Cochrane Feed Water Heaters and of the Sorge-Cochrane System.

STILWELL'S FEED WATER HEATER

USES EXHAUST STEAM TO HEAT AND PURIFY THE WATER FOR YOUR BOILER.

ITS USE INSURES CLEAN BOILERS, GREATER EFFICIENCY AND SMALLER FUEL BILLS.

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## BIRMINGHAM, ALABAMA

Manufacturing following well known brands of Foundry Iron:

**"Sloss," "Florence," "Sheffield," "Lady Ensley,"**

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| Robert Field, 1105 Traction Building | Cincinnati, O. |
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| E. C. Smith, 506 Commonwealth Trust Building | St. Louis, Mo. |
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| Hardy Greenwood, P. O. Box 751 | San Antonio, Tex. |
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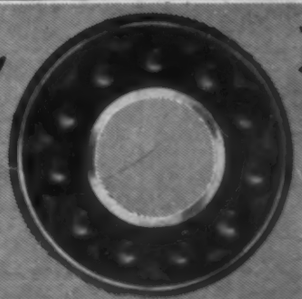
Cable address, SLOSS, BIRMINGHAM, using Lieber's A-1, Watkins, Western Union Telegraphic and the Atlantic Cable Directory Codes.

# STEEL BALLS



The test of quality lies in service. The best balls are known as "High Duty." We make them.

Something more than a micrometer is needed to distinguish good balls from bad ones.

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CLEVELAND BALL FACTORY—Cleveland

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General Offices at LEBANON, PA., U.S.A.

MANUFACTURERS OF

## *Merchant Bar Iron and Steel*

(ANNUAL CAPACITY ABOUT 150,000 TONS)

ALSO EVERY VARIETY OF

Machine Bolts, Nuts, Washers, Turnbuckles, Lag Screws, Railway and Dock Spikes, Harvey Grip and other Railway Track Bolts. Boiler, Ship and Structural Rivets. Car Forgings and Rods and Irons for Bridges, Buildings, Etc., Etc.

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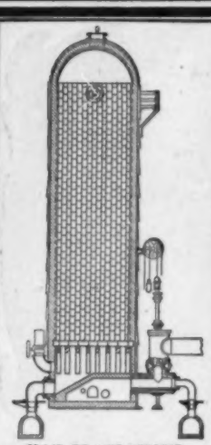

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**PIG IRON PRODUCTION COSTS**
***are greatly* reduced *by the use of***

## The Kloman Gas Washer and The Kloman Hot Blast Stove

Send size and capacity of your furnace and we will submit estimates and blue prints

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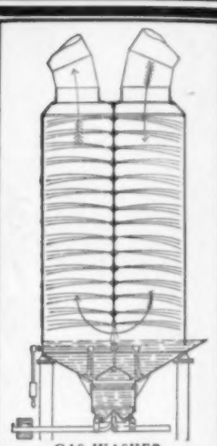
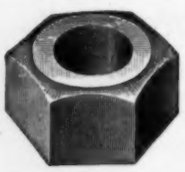


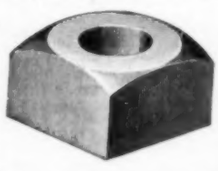
GAS WASHER

# The Milton Manufacturing Co.

MILTON, PA.



***Manufacturers of*** **COLD PUNCHED NUTS**



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Quality and Finish the Best. Send Specifications for Prices.

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**Bolts**

HOT PRESSED
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SEMI-FINISHED
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**Nuts**

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**Coach and Lag Screws, Washers, Boiler and Structural Rivets, all of the highest possible quality and finish.**

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**WIRE OF EVERY DESCRIPTION**—round, flat, square, triangular, and odd-shaped, music wire, mattress, broom, weaving and market wires in all finishes. Special wires adapted to all purposes.

**WIRE HOOPS** for use on lime barrels, sugar, salt, produce, apple, cracker, cement and flour barrels and other slack cooperage.

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**RAIL BONDS,** for electric railroads.

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Wrought Merchant Pipe, all kinds: sizes 1-8-inch to 30-inch, fitted in any manner desired.

***Boiler Tubes,***

Mild Steel and Charcoal Iron, for Stationary, Locomotive and Marine Work.

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Lap-Welded and Seamless, tested from 100 to 3,700 lbs., for Compressed Air, Carbonic Acid Gas, Anhydrous Ammonia, etc., etc., etc.

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Manufacturers of all varieties of

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Rails, Blooms, Billets and Slabs.

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# Steel and Iron Sheets

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*Specialty: Sable Brand Best Forging Iron* Zug & Co., Ltd., Pittsburg, Pa.


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BLACK PLAIN and PAINTED. FLAT, CORRUGATED and "V" CRIMPED.

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MACHINE and DRIFT BOLTS

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is so carefully made, by hand labor, and so many precautions taken to send out only perfect plates, it invariably makes a roof that will last half a century or more. This (MF) trademark stamped on every sheet. Ask your roofer for M F Roofing Tin, or

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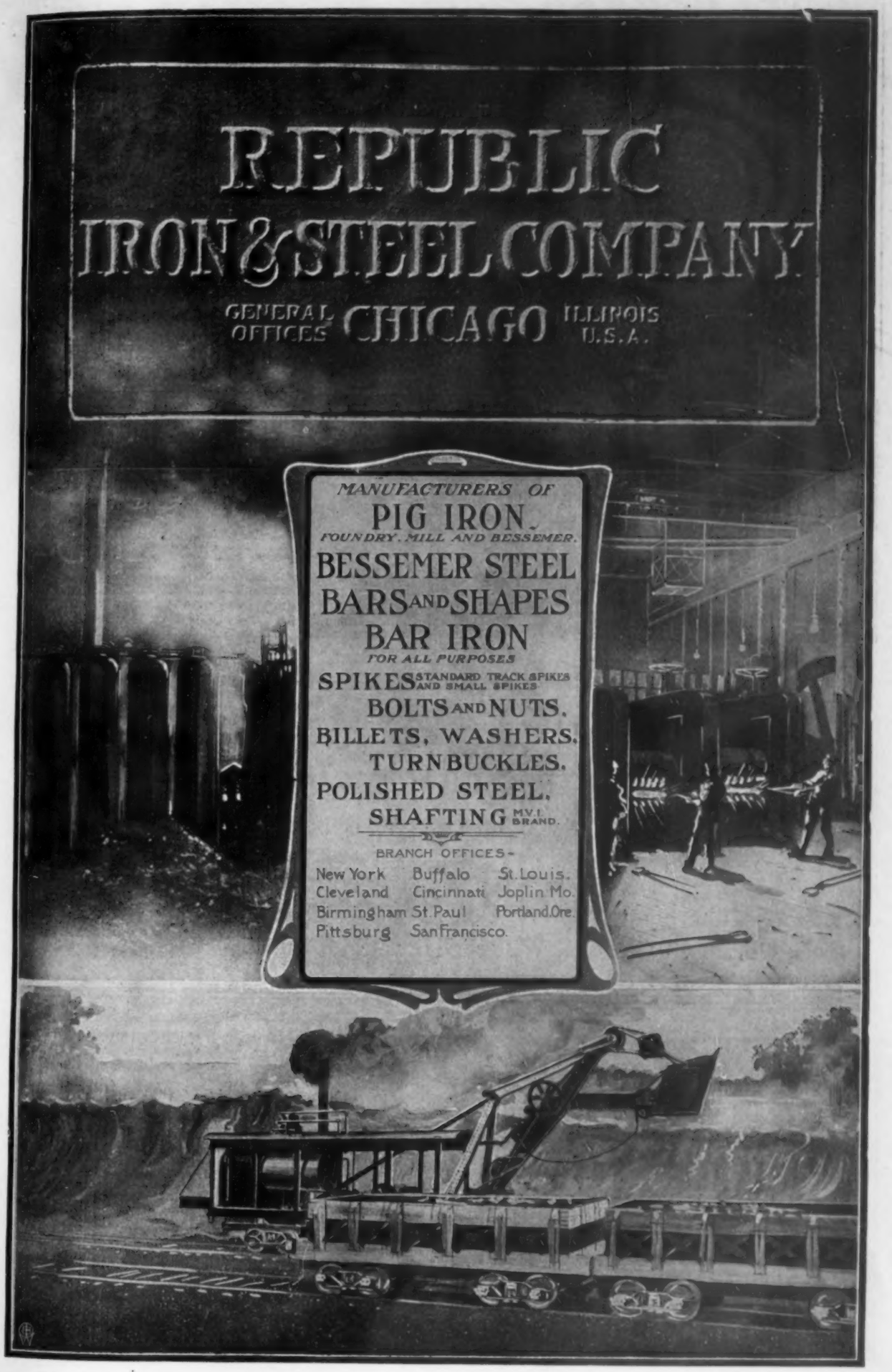
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FOR ALL PURPOSES
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WEIGHT, 55,000 LBS.

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Flange Plates, Ship Plates, Tank Plates, Steel Car Axles, and Forgings of all kinds.

**Steel Castings from 100 to 75,000 lbs.**

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Produces Sound Ingots, Removes Blowholes and Flaws, Reduces Liability of Cracking and Increases Tensile Strength in Iron, Steel and Chilled Iron CASTINGS

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**EXTRA DOUBLE GALVANIZED**
**TELEGRAPH AND TELEPHONE WIRE — WIRE STRAND**
**All sizes and kinds SPECIAL WIRE for every purpose**

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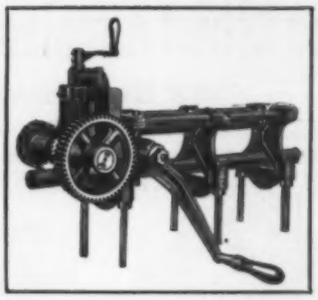
# IRON WORKERS' TOOLS

**PORTABLE KEYSEATER**



**This machine will mill Keyseats in the center or on the end of shafting from 1¼ to 5 inches diameter without removing it from its hanger boxes.**

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**A SINGLE MACHINE** may be all you want just now. Send in your order—it will receive the same prompt attention as a larger one.

***WIRE MILLS, CHAIN FACTORIES***

**A COMPLETE INSTALLATION** the whole thing from A to Z may be your need. We will furnish you an equipment unequalled anywhere.

Write for prices stating capacity wanted.

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THE PORTSMOUTH MAN'F'G CO. PORTSMOUTH OHIO
HIGH GRADE
FIRE BRICK
BEST BLAST FURNACE & STEEL WORKS BRICK

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SET, CAP and MACHINE
Hexagon Nuts, SCREWS. Coupling Bolts
Studs, Etc. Specials.
No. 2 N. Canal St., : : CHICAGO.

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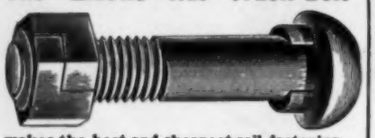

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9,024 miles of high standard railway in the States of
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Also through traffic arrangements covering points in Colorado, Utah, Idaho, Montana, Nevada, California, Oregon and Washington.
The Pioneer Overland Route
Fast Through Trains daily. Equipment and Time the best.
Splendid Service to the Lake Superior Iron and Copper Country.
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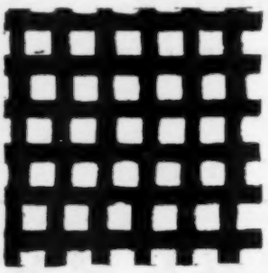
Trommels, Jigs, Battery Screens, Grizzly Plates, Coal and Ore Screens.



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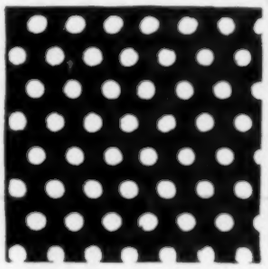

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AS REQUIRED FOR
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SPECIAL SCREENS FOR COAL AND COKE.
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Perforated Plates
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Write for Prices.

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ESTABLISHED 1855

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Specially adapted to places where belts are exposed to water heat, steam, oils, atmospheric changes, etc. Costs about one-half as much as the best leather belt on the market—has greater lasting qualities and will outwear any other make of belt. It is used with the greatest satisfaction as a main driver, conveyor or carrier. Give the Gandy Belt a trial and be convinced of its high merit. Beware of imitations. The real article stamped every ten feet. "Original Gandy Belt." Sole manufacturers.
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Manufacturers of
**Sheet Iron and Sheet Steel,**
also **Corrugated Iron.**

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IRON, STEEL and HARDWARE
BARS, PLATES, SHEETS, ANGLES, &C.
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Steel Plate Work
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THAT CANNOT FAIL.
Highest Award Pan-American Exposition.

Made with 12 or 24 different keys. Contain all the modern improvements. Warranted in every way. Cannot be tampered with, without detection.
Manufactured by
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**STRUCTURAL STEEL**
**PREPARATORY TO REMOVAL OF PLANT**
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*By John F. Buchanan*

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BLUEFIELD, W. VA.

can now make prompt shipments 72-hour Pocahontas Foundry Coke and Blast Furnace Coke suitable for smelting Bessemer iron.

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Manufacturers of **FIRE BRICK.**
Phone 1131. Established 1845.
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High Grade Fire and Silica BRICK a Specialty.
**JOS. SOISSON FIRE BRICK CO.,**
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FOR
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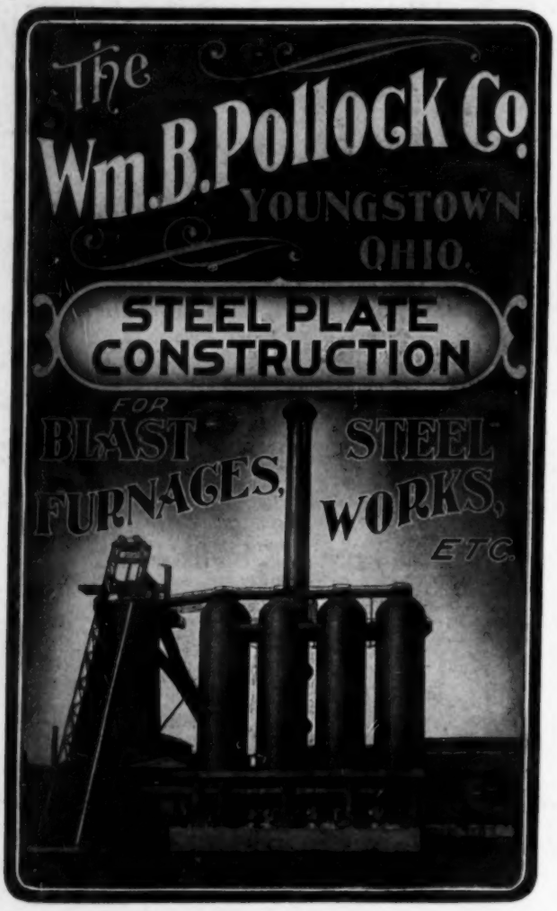


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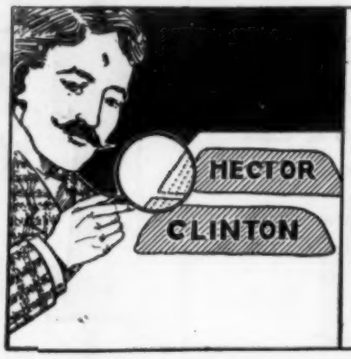

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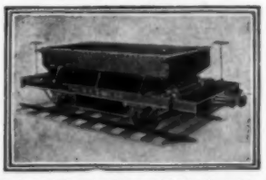

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Pratt & Whitney Co., Hartford, Conn.
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Mechanics Machine Co., Rockford, Ill.
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Cincinnati Milling Machine Co., Cincinnati, O.
Hill, Clarke & Co., Boston, Mass.
Kearney & Trecker, Milwaukee, Wis.
Keystone Machine Tool Wks., Philadelphia
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Newton Machine Tool Wks., Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.
J. R. Vandyck Co., New York City.
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Hill, Clarke & Co., Boston, Mass.
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American Tool Works Co., Cincinnati, O.
Bement, Miles & Co., Philadelphia, Pa.
Brown & Zortman Machy. Co., Pittsburg, Pa.
Cincinnati Shaper Co., Cincinnati, O.
Fox Machine Co., Grand Rapids, Mich.
Hill, Clarke & Co., Boston, Mass.
J. J. McCabe, New York City.
Potter & Johnston Mach. Co., Pawtucket, R.I.
Chas. G. Smith Co., Pittsburg, Pa.
Stockbridge Machine Co., Worcester, Mass.
J. R. Vandyck Co., New York City.
SHOP FURNITURE—
The Globe Machine & Stamping Co., Cleveland, O.
New Britain Machine Co., New Britain, Conn.
SLOTTERS—
Baker Bros., Toledo, O.
Bement, Miles & Co., Philadelphia, Pa.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., New York City.
STEEL KEYS—
Standard Gauge Steel Co., Beaver Falls, Pa.
STOCKS AND DIES—
Armstrong Mfg. Co., Bridgeport, Conn.
Curtis & Curtis Co., Bridgeport, Conn.
Geometric Drill Co., Westville, Conn.
TAPS AND DIES—
Geometric Drill Co., Westville, Conn.
TAPPING MACHINES (NUT)—
Acme Machinery Co., Cleveland, O.
Baker Bros., Toledo, O.
Hazelton & Donald, Philadelphia, Pa.
National Machinery Co., Tiffin, O.
Francis Reed Co., Worcester, Mass.
Williams Tool Co., Erie, Pa.
TAPS (COLLAPSING)—
Geometric Drill Co., Wellsville, Conn.
TAPPING MACHINES AND ATTACHMENTS—
Baker Bros., Toledo, O.
Cincinnati Machine Tool Co., Cincinnati, O.
THREAD CUTTING TOOLS—
Armstrong Mfg. Co., Bridgeport, Conn.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Curtis & Curtis Co., Bridgeport, Conn.
Fox Machine Co., Grand Rapids, Mich.
Pratt & Whitney Co., Hartford, Conn.
Taylor Wilson & Co., Limited, Allegheny, Pa.
Williams Tool Co., Erie, Pa.
TOOL HOLDERS—
Armstrong Bros. Tool Co., Chicago, Ill.
TOOL RACKS—
New Britain Machine Co., New Britain, Conn.
TURRET MACHINES—
Automatic Mach. Co., Greenfield, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Machine Tool Co., Bridgeport, Conn.
Geometric Drill Co., Westville, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Niles Tool Works Co., New York City.
Potter & Johnston Mach. Co., Pawtucket, R.I.
Pratt & Whitney Co., Hartford, Conn.
Chas. G. Smith Co., Pittsburg, Pa.
TWIST DRILLS—
F. B. McCrosky, Cincinnati, O.
UNIVERSAL JOINTS—
Baush Machine Tool Co., Springfield, Mass.
VISES—
Hanna Engineering Works, Chicago, Ill.
Merrill Bros., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.
WRENCHES (MACHINISTS)—
Billings & Spencer Co., Hartford, Conn.

# DIVISION II
# General Machinery

ACCUMULATORS—
Alliance Machine Co., Alliance, O.
Bement, Miles & Co., Philadelphia, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Diamond Drill & Mach. Co., Birdsboro, Pa.
Mesta Machine Co., Pittsburg, Pa.
Morgan Construction Co., Worcester, Mass.
United Engineering & Fdy. Co., Pittsburg, Pa.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.
Watson-Stillman Co., New York City.
R. D. Wood & Co., Philadelphia, Pa.
AIR COMPRESSORS—
The Allis-Chalmers Co., Chicago, Ill.
American Air Compressor Works, N. Y. City.
General Pneumatic Tool Co., Montour Falls, N. Y.
Herron & Bury Mfg. Co., Erie, Pa.
Ingersoll-Sergeant Drill Co., New York City.
Laidlaw-Dunn-Gordon Co., New York City.
Rand Drill Co., New York City.
Scully Steel & Iron Co., Chicago, Ill.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
BAND SAW FILING DEVICES—
New Britain Machine Co., New Britain, Conn.
BAND SAW SETTING MACHINES—
New Britain Machine Co., New Britain, Conn.
BENDING MACHINES—
Alliance Machine Co., Alliance, O.
Bement, Miles & Co., Philadelphia, Pa.
Bertsch & Co., Cambridge City, Ind.
Chambersburg Engineering Co., Chambersburg, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
National Machy. Co., Tiffin, O.
Watson-Stillman Co., New York City.
Williams, White & Co., Moline, Ill.
R. D. Wood & Co., Philadelphia, Pa.
BOLT AND NUT MACHINERY—
Acme Machinery Co., Cleveland, O.
Baird Machinery Co., Pittsburg, Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.
National Machinery Co., Tiffin, O.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.
Williams Tool Co., Erie, Pa.
BRIQUETTING MACHINERY—
Henry S. Mould Co., Pittsburg, Pa.
BULLDOZERS—
National Machinery Co., Tiffin, O.
Williams, White & Co., Moline, Ill.
CABLEWAYS—
Lidgerwood Mfg. Co., New York City.
CHAIN MACHINERY—
Turner, Vaughn & Taylor Co., Cuyahoga Falls, Ohio.
CLUTCHES—
Aultman Co., Canton, O.
Brown Hoisting Machy. Co., Cleveland, O.
Buhl Malleable Co., Detroit, Mich.
Dodge Mfg. Co., Mishawaka, Ind.
Link-Belt Machinery Co., Chicago, Ill.
Chas. G. Smith Co., Pittsburg, Pa.
CLUTCHES (FRICTION)—
Benedict Mfg. Co., Salamanca, N. Y.
COAL CUTTERS—
Ingersoll-Sergeant Drill Co., New York City.
Jeffrey Mfg. Co., Columbus, O.
CONVEYING MACHINERY—
The Allis-Chalmers Co., Chicago, Ill.
The Aultman Co., Canton, O.
C. O. Bartlett & Snow Co., Cleveland, O.
The Brown Hoisting Machy. Co., Cleveland.
Browning Engineering Co., Cleveland, O.
Buhl Malleable Co., Detroit, Mich.
H. W. Caldwell & Son Co., Chicago, Ill.
Case Manufacturing Co., Columbus, O.
Dodge Mfg. Co., Mishawaka, Ind.
Federal Manufacturing Co., Cleveland, O.
C. W. Hunt Co., West New Brighton, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Kaltenbach & Griess, Cleveland, O.
Arthur Koppel, New York City.
Lidgerwood Mfg. Co., New York City.
Link-Belt Machinery Co., Chicago, Ill.
McLanahan-Stone Mach. Co., Hollidaysburg, Pa.
Morse Chain Co., Trumansburg, N. Y.
Robins Conveying Belt Co., New York City.
Russel Wheel & Fdy. Co., Detroit, Mich.
M. H. Treadwell & Co., New York City.
Wellman-Seaver-Morgan Engineering Co., Cleveland, O.
COUNTERSHAFTS (VARIABLE SPEED)—
Mesta Machine Co., Pittsburg, Pa.
Morgan Construction Co., Worcester, Mass.
Power & Speed Regulator Mfg. Co., Kalamazoo, Mich.
United Engineering & Fdy. Co., Pittsburg, Pa.
Watson-Stillman Co., New York City.
R. D. Wood & Co., Philadelphia, Pa.
CRANES (ELECTRIC)—
Alliance Machine Co., Alliance, O.
Brown Hoisting Machy. Co., Cleveland, O.
Browning Engineering Co., Cleveland, O.
Case Mfg. Co., Columbus, O.
Cleveland Crane & Car Co., Wickliffe, O.
General Pneumatic Tool Co., Montour Falls, N. Y.
Morgan Construction Co., Worcester, Mass.
Niles Tool Works Co., New York City.
Northern Engineering Works, Detroit, Mich.
S. Obermayer Co., Cincinnati, O.
Pawling & Harnischfeger, Milwaukee, Wis.
M. H. Treadwell & Co., New York City.
Wellman-Seaver-Morgan Engineering Co., Cleveland, O.
Youngstown Engineering Co., Youngstown, O.
CRANES (HAND POWER)—
J. G. Speidel, Reading, Pa.
CRANES (HYDRAULIC)—
Alliance Machine Co., Alliance, O.
Bement, Miles & Co., Philadelphia, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
United Engineering & Fdy. Co., Pittsburg, Pa.
Wellman-Seaver-Morgan Engineering Co., Cleveland, O.
R. D. Wood & Co., Philadelphia, Pa.
CRANES (JIB)—
Alliance Machine Co., Alliance, O.
Bement, Miles & Co., Philadelphia, Pa.
Cleveland Crane & Car Co., Wickliffe, O.
Craig Ridgway & Son, Coatesville, Pa.
Dobbie Fdy. & Mach. Co., Niagara Falls, N. Y.
Farrel Fdy. & Mach. Co., Ansonia, Conn.
Garry Iron & Steel Co., Cleveland, O.
General Pneumatic Tool Co., Montour Falls, N. Y.
Industrial Works, Bay City, Mich.
Niles Tool Works Co., New York City.
Northern Engineering Works, Detroit, Mich.
S. Obermayer Co., Cincinnati, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.
R. D. Wood & Co., Philadelphia, Pa.
CRANES (LOCOMOTIVE)—
Alliance Machine Co., Alliance, O.
Browning Engineering Co., Cleveland, O.
Garry Iron & Steel Co., Cleveland, O.
Industrial Works, Bay City, Mich.
Kaltenbach & Griess, Cleveland, O.
Northern Engineering Works, Detroit, Mich.
M. H. Treadwell & Co., New York City.
CRANES (PORTABLE)—
Garry Iron & Steel Co., Cleveland, O.
CRUSHING MACHINERY (COAL AND ORE)—
The Allis-Chalmers Co., Chicago, Ill.
Aultman Co., Canton, O.
C. O. Bartlett & Snow Co., Cleveland, O.
Diamond Drill & Mach. Co., Birdsboro, Pa.
Farrel Fdy. & Mach. Co., Ansonia, Conn.
A. Garrison Foundry Co., Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
McLanahan-Stone Mach. Co., Hollidaysburg, Pa.
Mesta Machine Co., Pittsburg, Pa.
R. S. Newbold & Son Co., Norristown, Pa.
United Engineering & Fdy. Co., Pittsburg, Pa.
CUTTERS (BOLT)—
Acme Machinery Co., Cleveland, O.
National Machinery Co., Tiffin, O.
Niles Tool Works, New York City.
DRAW BENCHES (WIRE)—
Iroquois Machine Co., New York City.
Morgan Construction Co., Worcester, Mass.
Hugh L. Thompson, Waterbury, Conn.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, Ohio.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.
Watson-Stillman Co., New York City.
DYNAMOS—
See Electrical Machy., Division II.
ELECTRIC CONTROLLERS—
Electric Controller & Supply Co., Cleveland,
ELECTRICAL MACHINERY—
Bartz, Wygant & Brown, Inc., Hornellsville, N. Y.
Elwell-Parker Electric Co., Cleveland, O.
National Electric Co., Milwaukee, Wis.
Northern Electrical Mfg. Co., Madison, Wis.
Quincy Engine Works, Quincy, Ill.
Stow Mfg. Co., Binghamton, N. Y.
ELEVATING AND CONVEYING MACHINERY—
See Conveying Machinery, Division II.
FLEXIBLE SHAFTS—
Stow Mfg. Co., Binghamton, N. Y.
FORGING MACHINES—
Acme Machinery Co., Cleveland, ...
Billings & Spencer Co., Hartford, Conn.
National Machinery Co., Tiffin, O.
Williams, White & Co., Moline, Ill.
GALVANIZING AND TINNING MACHINERY—
Turner, Vaughn & Taylor Co., Cuyahoga Falls, Ohio.
HAMMERS (DROP)—
Alliance Machine Co., Alliance, O.
Bement, Miles & Co., Philadelphia, Pa.
Billings & Spencer Co., Hartford, Conn.
Cleveland Punch & Shear Works Co., Cleveland, O.
Iroquois Machine Co., New York City.
Merrill Bros., Brooklyn, N. Y.
Pittsburg Shear, Knife & Mach. Co., Pittsburg, Pa.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.
Williams, White & Co., Moline, Ill.
HAMMERS FOR CHAIN WELDING (POWER & FOOT)—
Turner, Vaughn & Taylor Co., Cuyahoga Falls, Ohio.
HAMMERS (PNEUMATIC)—
Cleveland Pneumatic Tool Co., Cleveland, O.
Thos. H. Dallett Co., Philadelphia, Pa.
General Pneumatic Tool Co., Montour Falls, N. Y.
Ingersoll-Sergeant Drill Co., New York City.
Rand Drill Co., New York City.
Joseph T. Ryerson & Son, Chicago, New York and Pittsburg.
Scully Steel & Iron Co., Chicago, Ill.
HAMMERS (POWER)—
Badger State Machine Co., Janesville, Wis.
Bement, Miles & Co., Philadelphia, Pa.
Cleveland Punch & Shear Works Co., Cleveland, Ohio.
E. E. Kidder, Worcester, Mass.
Merrill Bros., Brooklyn, N. Y.

Niles Tool Works Co., New York City.
Scully Steel & Iron Co., Chicago, Ill.
Williams, White & Co., Moline, Ill.

HAMMERS (ROTARY RIVETING)—
F. B. Shuster Co., New Haven, Conn.
Williams, White & Co., Moline, Ill.

HAMMERS (STEAM)—
Alliance Machine Co., Alliance, O.
Bement, Miles & Co., Philadelphia, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Falkenau-Sinclair Mach. Co., Philadelphia, Pa.
F. R. Phillips & Sons Co., Philadelphia, Pa.
Pittsburg Shear, Knife & Mach. Co., Pittsburg, Pa.
Scully Steel & Iron Co., Chicago, Ill.

HOISTING MACHINERY—
The Aultman Co., Canton, O.
The Brown Hoisting Machy. Co., Cleveland, O.
Browning Engineering Co., Cleveland, O.
Buhl, Malleable Co., Detroit, Mich.
H. W. Caldwell & Son Co., Chicago, Ill.
Dobbie Fdy. & Mach. Co., Niagara Falls, N. Y.
C. W. Hunt Co., West New Brighton, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Kaltenbach & Griess, Cleveland, O.
Lidgerwood Mfg. Co., New York City.
Link-Belt Machinery Co., Chicago, Ill.
J. G. Speidel, Reading, Pa.
Wellman-Seaver-Morgan Engineering Co., Cleveland, O.
Quincy Engine Works, Quincy, Ill.

HOISTS (AIR)—
General Pneumatic Tool Co., Montour Falls, N. Y.
Northern Engineering Wks., Detroit, Mich.
Scully Steel & Iron Co., Chicago, Ill.

HOISTS (CHAIN)—
Chisholm & Moore Mfg. Co., Cleveland, O.
General Pneumatic Tool Co., Montour Falls, N. Y.
Niles Tool Works Co., New York City.
Scully Steel & Iron Co., Chicago, Ill.
J. G. Speidel, Reading, Pa.

HOISTS (PNEUMATIC)—
Garry Iron & Steel Co., Cleveland, O.
General Pneumatic Tool Co., Montour Falls, N. Y.
Niles Tool Works Co., New York City.
Northern Engineering Works, Detroit, Mich.
Rand Drill Co., New York City.
Scully Steel & Iron Co., Chicago, Ill.

MINING MACHINERY—
The Allis-Chalmers Co., Chicago, Ill.
The Atlas Car & Mfg. Co., Cleveland, O.
The Bucyrus Co., South Milwaukee, Wis.
Buhl Malleable Co., Detroit, Mich.
Wm. Cramp & Sons, Philadelphia, Pa.
Diamond Drill & Mach. Co., Birdsboro, Pa.
Dravo, Doyle & Co., Pittsburg, Pa.
Great Lakes Engineering Co., Detroit, Mich.
C. W. Hunt Co., West New Brighton, N. Y.
Ingersoll-Sergeant Drill Co., New York City.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Link-Belt Machinery Co., Chicago, Ill.
Marion Steam Shovel Co., Marion, O.
McLanahan-Stone Mach. Co., Hollidaysburg, Pa.
Quincy Engine Works, Quincy, Ill.
Superior Iron Works, Superior, Wis.
Thew Automatic Shovel Co., Lorain, O.
M. H. Treadwell & Co., New York City.
Vulcan Iron Works Co., Toledo, O.

ORE HANDLING MACHINERY—
Atlas Car & Mfg. Co., Cleveland, O.
Buhl Malleable Co., Detroit, Mich.
C. W. Hunt Co., West New Brighton, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Kaltenbach & Griess, Cleveland, O.
Arthur Koppel, New York City.
Link-Belt Machinery Co., Chicago, Ill.
M. H. Treadwell & Co., New York City.
Vulcan Iron Works Co., Toledo, O.
Wellman-Seaver-Morgan Engineering Co., Cleveland, O.

PIPE CUTTING AND THREADING MACHINES—
See Thread Cutting Tools, Division I.

PIPE FITTERS—
Pittsburg Valve, Fdy. & Cons. Co., Pittsburg,

PIPE MILL MACHINERY—
Taylor Wilson & Co., Limited, Allegheny, Pa.

PNEUMATIC TOOLS—
Cleveland Pneumatic Tool Co., Cleveland, O.
Thos. H. Dallett Co., Philadelphia, Pa.
General Pneumatic Tool Co., Montour Falls, N. Y.
Ingersoll-Sergeant Drill Co., New York City.
Rand Drill Co., New York City.
Scully Steel & Iron Co., Chicago, Ill.

POINTING MACHINES (WIRE)—
Morgan Construction Co., Worcester, Mass.
The F. B. Shuster Co., New Haven, Conn.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, Ohio.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.

PRESSES (BLANKING)—
Billings & Spencer Co., Hartford, Conn.
Blake & Johnson, Waterbury, Conn.
Cleveland Punch & Shear Works Co., Cleveland, O.
Falkenau-Sinclair Mach. Co., Philadelphia, Pa.
Fox Machine Co., Grand Rapids, Mich.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.

PRESSES (FORGING)—
Alliance Machine Co., Alliance, O.
Avery Stamping Co., Cleveland, O.
Bement, Miles & Co., Philadelphia, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Cincinnati Punch & Shear Co., Cincinnati, O.
Falkenau-Sinclair Mach. Co., Philadelphia, Pa.
Fox Machine Co., Grand Rapids, Mich.
Niles Tool Works Co., New York City.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Watson-Stillman Co., New York City.
Williams, White & Co., Moline, Ill.

PRESSES (FOOT)—
Blake & Johnson, Waterbury, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

PRESSES FOR SEWER PIPE (CLAY)—
Turner, Vaughn & Taylor Co., Cuyahoga Falls, Ohio.

PRESSES (HYDRAULIC)—
Alliance Machine Co., Alliance, O.
Bement, Miles & Co., Philadelphia, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Diamond Drill & Mach. Co., Birdsboro, Pa.
Farrel Fdy. & Mach. Co., Ansonia, Conn.
Great Lakes Engineering Wks., Detroit, Mich.
Morgan Construction Co., Worcester, Mass.
Geo. B. Sennett Co., Youngstown, O.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.
Watson-Stillman Co., New York City.
R. D. Wood & Co., Philadelphia, Pa.

PRESSES (POWER)—
Alliance Machine Co., Alliance, O.
Automatic Machine Co., Bridgeport, Conn.
Avery Stamping Co., Cleveland, O.
Badger State Machine Co., Janesville, Wis.
Bertsch & Co., Cambridge City, Ind.
Blake & Johnson, Waterbury, Conn.
Falkenau-Sinclair Mach. Co., Philadelphia, Pa.
Fox Machine Co., Grand Rapids, Mich.
Niles Tool Works Co., New York City.
Geo. B. Sennett Co., Youngstown, O.
F. B. Shuster Co., New Haven, Conn.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.
Watson-Stillman Co., New York City.
R. D. Wood & Co., Philadelphia, Pa.

PRESSES (SCREW)—
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

PUMPS (POWER)—
The Allis-Chalmers Co., Chicago, Ill.
Quincy Engine Works, Quincy, Ill.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.

PUMPS (STEAM)—
The Allis-Chalmers Co., Chicago, Ill.
A. S. Cameron Steam Pump Works, New York.
Dravo, Doyle & Co., Pittsburg, Pa.
Great Lakes Engineering Wks., Detroit, Mich.
Ingersoll-Sergeant Drill Co., New York City.
F. M. Prescott Steam Pump Co., Milwaukee, Wis.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Stilwell-Bierce & Smith-Valle Co., Dayton, O.
Union Steam Pump Co., Battle Creek, Mich.
Watson-Stillman Co., New York City.
R. D. Wood & Co., Philadelphia, Pa.

PUNCHES (HYDRAULIC)—
Alliance Machine Co., Alliance, O.
Bement, Miles & Co., Philadelphia, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Diamond Drill & Mach. Co., Birdsboro, Pa.
R. S. Newbold & Son Co., Norristown, Pa.
Pittsburg Shear, Knife & Mach. Co., Pittsburg, Pa.
United Engineering & Fdy. Co., Pittsburg, Pa.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Watson-Stillman Co., New York City.
R. D. Wood & Co., Philadelphia, Pa.

PUNCHES (POWER)—
Alliance Machine Co., Alliance, O.
Badger State Machine Co., Janesville, Wis.
Bement, Miles & Co., Philadelphia, Pa.
Bertsch & Co., Cambridge City, Ind.
Bignall-Keeler Mfg. Co., Edwardsville, Ill.
Blake & Johnson, Waterbury, Conn.
Chambersburg Engineering Co., Chambersburg, Pa.
Cincinnati Punch & Shear Co., Cincinnati, O.
Cleveland Punch & Shear Works Co., Cleveland, O.
Falkenau-Sinclair Mach. Co., Philadelphia, Pa.
E. E. Johnson, Putnam, Conn.
National Machinery Co., Tiffin, O.
R. S. Newbold & Son Co., Norristown, Pa.
Niles Tool Works Co., New York City.
Patterson, Gottfried & Hunter, Ltd., New York City.
Henry Pels & Co., New York City.
Pittsburg Shear, Knife & Mach. Co., Pittsburg, Pa.
Scully Steel & Iron Co., Chicago, Ill.
Geo. B. Sennett Co., Youngstown, O.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.
Watson-Stillman Co., New York City.
Williams, White & Co., Moline, Ill.
R. D. Wood & Co., Philadelphia, Pa.

RAIL BENDERS—
Espen-Lucas Mach. Works, Philadelphia, Pa.
Williams, White & Co., Moline, Ill.

RIVETING MACHINES (HYDRAULIC)—
Alliance Machine Co., Alliance, O.
John F. Allen, New York City.
Bement, Miles & Co., Philadelphia, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
General Pneumatic Tool Co., Montour Falls, N. Y.
Watson-Stillman Co., New York City.
R. D. Wood & Co., Philadelphia, Pa.

RIVETING MACHINES (PNEUMATIC)—
John F. Allen, New York City.
Bement, Miles & Co., Philadelphia, Pa.
Blake & Johnson, Waterbury, Conn.
Cleveland Punch & Shear Works Co., Cleveland, O.
Thos. H. Dallett Co., Philadelphia, Pa.
General Pneumatic Tool Co., Montour Falls, N. Y.
Ingersoll-Sergeant Drill Co., New York City.
Philadelphia Pneumatic Tool Co., Philadelphia, Pa.
Cleveland Pneumatic Tool Co., Cleveland, O.
Rand Drill Co., New York City.
Joseph T. Ryerson & Son, Chicago, New York and Pittsburg.
Scully Steel & Iron Co., Chicago, Ill.

RIVETING MACHINES (STEAM)—
Alliance Machine Co., Alliance, O.
Blake & Johnson, Waterbury, Conn.
Chambersburg Engineering Co., Chambersburg, Pa.
General Pneumatic Tool Co., Montour Falls, N. Y.

RIVET MACHINERY—
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

ROCK DRILLS—
Ingersoll-Sergeant Drill Co., New York City.
Jeffery Mfg. Co., Columbus, O.
Rand Drill Co., New York City.

ROLLS (SAND, CHILLED AND STEEL)—
Farrel Fdy. & Mach. Co., Ansonia, Conn.
A. Garrison Foundry Co., Pittsburg, Pa.
George A. Hogg Iron & Steel Foundry Co., Pittsburg, Pa.
Lorain Foundry Co., Lorain, O.
Mesta Machine Co., Pittsburg, Pa.
F. R. Phillips & Sons Co., Philadelphia, Pa.
Seaman, Sleeth Co., Pittsburg, Pa.
United Engineering & Fdy. Co., Pittsburg, Pa.
Wm. Tod & Co., Youngstown, O.
Wheeling Mold & Fdy. Co., Wheeling, W. Va.

ROLLING MILL MACHINERY—
Alliance Machine Co., Alliance, O.
Blake & Johnson, Waterbury, Conn.
Diamond Drill & Mach. Co., Birdsboro, Pa.
Farrel Fdy. & Mach Co., Ansonia, Conn.
Fischer Fdy. & Machine Co., Pittsburg, Pa.
A. Garrison Foundry Co., Pittsburg, Pa.
Girard Boiler & Mfg. Co., Girard, O.
George A. Hogg Iron & Steel Foundry Co., Pittsburg, Pa.
Iroquois Machine Co., New York City.
Macbeth Iron Co., Cleveland, O.
Mahoning Fdy. & Mach. Co., Youngstown, O.
Mesta Machine Co., Pittsburg, Pa.
Morgan Construction Co., Worcester, Mass.
R. S. Newbold & Son Co., Norristown, Pa.
F. R. Phillips & Sons Co., Philadelphia, Pa.
Quincy Engine Works, Quincy, Ill.
Hugh L. Thompson, Waterbury, Conn.
M. H. Treadwell & Co., New York City.
United Engineering & Fdy. Co., Pittsburg, Pa.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.
Wellman-Seaver-Morgan Engineering Co., Cleveland, O.
Wheeling Mold & Fdy. Co., Wheeling, W. Va.

SAWING OFF MACHINES (METAL)—
See Cutting Off Machines, Division I.

SHEARS (ALLIGATOR)—
Cincinnati Punch & Shear Co., Cincinnati, O.
Cleveland Punch & Shear Works Co., Cleveland, O.
Farrel Fdy. & Mach. Co., Ansonia, Conn.
National Machinery Co., Tiffin, O.
Scully Steel & Iron Co., Chicago, Ill.
Geo. B. Sennett Co., Youngstown, O.
United Engineering & Fdy. Co., Pittsburg, Pa.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Watson-Stillman Co., New York City.

SHEARS (BEAM AND CHANNEL)—
Alliance Machine Co., Alliance, O.
Bement, Miles & Co., Philadelphia, Pa.
Bertsch & Co., Cambridge City, Ind.
Cincinnati Punch & Shear Co., Cincinnati, O.
Cleveland Punch & Shear Works Co., Cleveland, O.
Geo. A. Hogg Iron & Steel Foundry Co., Pittsburg, Pa.
Henry Pels & Co., New York City.
Scully Steel & Iron Co., Chicago, Ill.
United Engineering & Fdy. Co., Pittsburg, Pa.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Watson-Stillman Co., New York City.
Williams, White & Co., Moline, Ill.

SHEARS (BEVELING)—
Cincinnati Punch & Shear Co., Cincinnati, O.
Cleveland Punch & Shear Works Co., Cleveland, O.
Niles Tool Works Co., New York City.
Scully Steel & Iron Co., Chicago, Ill.
Geo. B. Sennett Co., Youngstown, O.
Williams, White & Co., Moline, Ill.

SHEARS (CIRCULAR)—
R. S. Newbold & Son Co., Norristown, Pa.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

SHEARS (HYDRAULIC)—
Alliance Machine Co., Alliance, O.
Bement, Miles & Co., Philadelphia, Pa.
Bertsch & Co., Cambridge City, Ind.
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

SHEARS (POWER)—
Badger State Machine Co., Janesville, Wis.
Cincinnati Punch & Shear Co., Cincinnati, O.
E. E. Johnson, Putnam, Conn.
Henry Pels & Co., New York City.
Patterson, Gottfried & Hunter, Limited, New York City.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

SHEAR KNIVES—
F. R. Phillips & Son Co., Philadelphia, Pa.
Pittsburg Shear, Knife & Mach. Co., Pittsburg, Pa.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
SPECIAL MACHINERY—
Alliance Machine Co., Alliance, O.
Blake & Johnson, Waterbury, Conn.
Thos. H. Dallett Co., Philadelphia, Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.
Diamond Drill & Mach. Co., Birdsboro, Pa.
Earle Gear & Machine Co., Philadelphia, Pa.
Eden & Co., Bridgeport, Conn.
Falkenau-Sinclair Mach. Co., Philadelphia, Pa.
Fox Machine Co., Grand Rapids, Mich.
The Globe Machine & Stamping Co., Cleveland, O.
R. E. Kidder, Worcester, Mass.
Macbeth Iron Co., Cleveland, O.
Mechanics Machine Co., Rockford, Ill.
National Machinery Co., Tiffin, O.
Potter & Johnston Mach. Co., Pawtucket, R.I.
Power & Speed Regulator Mfg. Co., Kalamazoo, Mich.
Quincy Engine Works, Quincy, Ill.
Russel Wheel & Foundry Co., Detroit, Mich.
F. B. Shuster Co., New Haven, Conn.
M. H. Treadwell & Co., New York City.
H. B. Underwood & Co., Philadelphia, Pa.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.
Williams Tool Co., Erie, Pa.
Williams, White & Co., Moline, Ill.
SPIKE MACHINES—
National Machinery Co., Tiffin, O.
STRAIGHTENING MACHINERY (WIRE)—
F. B. Shuster Co., New Haven, Conn.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.
STRAIGHTENING MACHINERY (PLATE AND BEAM)—
Bement, Miles & Co., Philadelphia, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Diamond Drill & Mach. Co., Birdsboro, Pa.
Falkenau-Sinclair Mach. Co., Philadelphia, Pa.
R. S. Newbold & Son Co., Norristown, Pa.
Niles Tool Works Co., New York City.
United Engineering & Fdy. Co., Pittsburg, Pa.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.
Williams, White & Co., Moline, Ill.
SWAGING MACHINES—
S. W. Goodyear, Waterbury, Conn.
Iroquois Machine Co., New York City.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.
TAPPING MACHINES—
Acme Machinery Co., Cleveland, O.
Baker Bros., Toledo, O.
National Machinery Co., Tiffin, O.
Niles Tool Works Co., New York City.
Stow Mfg. Co., Binghamton, N. Y.
TESTING MACHINES—
Falkenau-Sinclair Mach. Co., Philadelphia, Pa.
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, Ohio.
United Engineering & Fdy. Co., Pittsburg, Pa.
THREAD CUTTING TOOLS—
See Thread Cutting Tools, Division I.
TIN PLATE MACHINERY—
Diamond Drill & Mach. Co., Birdsboro, Pa.
George A. Hogg Iron & Steel Foundry Co., Pittsburg, Pa.
R. S. Newbold & Son Co., Norristown, Pa.
F. R. Phillips & Sons Co., Philadelphia, Pa.
United Engineering & Fdy. Co., Pittsburg, Pa.
TRANSMISSION MACHINERY (POWER)—
See Power Transmission Machinery Division IV.
TRUCKS—
Atlas Car & Mfg. Co., Cleveland, O.
C. W. Hunt Co., West New Brighton, N. Y.
Arthur Koppel, New York City.
Northern Engineering Works, Detroit, Mich.
Russel Wheel & Fdy. Co., Detroit, Mich.
M. H. Treadwell & Co., New York City.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, Ohio.
UPSETTING MACHINES—
Acme Machinery Co., Cleveland, O.
National Machinery Co., Tiffin, O.
WASHER MACHINERY—
The National Machinery Co., Tiffin, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
WIRE NAIL MACHINERY—
Blake & Johnson, Waterbury, Conn.
The National Machinery Co., Tiffin, O.
WIRE WORKING AND FORMING MACHINERY—
Automatic Machine Co., Bridgeport, Conn.
Blake & Johnson, Waterbury, Conn.
S. W. Goodyear, Waterbury, Conn.
Joseph T. Ryerson & Son, Chicago, New York and Pittsburg.
F. B. Shuster Co., New Haven, Conn.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, Ohio.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.

## DIVISION III

# Foundry Equipment and Supplies

AIR COMPRESSORS.
See Air Compressors, Division II.
ANNEALING BOXES—
Girard Boiler & Mfg. Co., Girard, O.
Meehan Boiler & Cons. Co., Lowellville, O.
Niles Boiler Co., Niles, O.
J. W. Paxson Co., Philadelphia, Pa.
Wm. B. Pollock Co., Youngstown, O.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
BARROWS (WHEEL)—
Atlas Bolt & Screw Co., Cleveland, O.
The S. Obermayer Co., Cincinnati and Chicago.
Wm. B. Pollock Co., Youngstown, O.
BELLOWS—
The S. Obermayer Co., Cincinnati and Chicago.
J. W. Paxson Co., Philadelphia, Pa.
The J. D. Smith Fdy. Supply Co., Cleveland.
BLOWERS—
The S. Obermayer Co., Cincinnati and Chicago.
J. W. Paxson Co., Philadelphia, Pa.
BRUSHES—
The S. Obermayer Co., Cincinnati and Chicago.
J. W. Paxson Co., Philadelphia, Pa.
CARS (FOUNDRY)—
Atlas Bolt & Screw Co., Cleveland, O.
C. W. Hunt Co., West New Brighton, N. Y.
Arthur Koppel, New York City.
Edgar S. Low Co., Pittsburg, Pa.
The Wm. B. Pollock Co., Youngstown, O.
Russel Wheel & Fdy. Co., Detroit, Mich.
M. H. Treadwell & Co., New York City.
COKE—
See Coal & Coke, Division VI.
CORE COMPOUND—
Chicago Flour Co., Chicago, Ill.
The S. Obermayer Co., Cincinnati and Chicago.
J. W. Paxson Co., Philadelphia, Pa.
The J. D. Smith Fdy. Supply Co., Cleveland.
CORE FLOUR—
Chicago Flour Co., Chicago, Ill.
The J. D. Smith Fdy. Supply Co., Cleveland.
CORE OVENS—
The S. Obermayer Co., Cincinnati and Chicago.
J. W. Paxson Co., Philadelphia, Pa.
The J. D. Smith Fdy. Supply Co., Cleveland.
Northern Engineering Works, Detroit, Mich.
CORE WIRE STRAIGHTENER—
F. B. Shuster Co., New Haven, Conn.
CRANES—
The Brown Hoisting Mach. Co., Cleveland.
Case Manufacturing Co., Columbus, O.
Cleveland Crane & Car Co., Wickliffe, O.
Craig Ridgway & Son, Coatesville, Pa.
Dobbie Fdy. & Mach. Co., Niagara Falls, N. Y.
Garry Iron & Steel Co., Cleveland, O.
General Pneumatic Tool Co., Montour Falls, N. Y.
The Industrial Works, Bay City, Mich.
Kaltenbach & Greiss, Cleveland, O.
Marion Steam Shovel Co., Marion, O.
Niles Tool Works Co., New York City.
The S. Obermayer Co., Cincinnati and Chicago.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.
M. H. Treadwell & Co., New York City.
Wellman-Seaver-Morgan Engineering Co., Cleveland, O.
R. D. Wood & Co., Philadelphia, Pa.
Youngstown Engineering Co., Youngstown, O.
CRUCIBLES—
Jos. Dixon Crucible Co., Jersey City, N. J.
The S. Obermayer Co., Cincinnati and Chicago.
J. W. Paxson Co., Philadelphia, Pa.
The J. D. Smith Fdy. Supply Co., Cleveland.
CUPOLAS—
Byram & Co., Detroit, Mich.
Girard Boiler & Mfg. Co., Girard, O.
The Meehan Boiler & Construction Co., Lowellville, O.
Northern Engineering Works, Detroit, Mich.
The S. Obermayer Co., Cincinnati and Chicago.
J. W. Paxson Co., Philadelphia, Pa.
The Wm. B. Pollock Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
The J. D. Smith Fdy. Supply Co., Cleveland.
DOWELS (BRASS AND HARD WOOD)—
Winkley Co., Hartford, Conn.
EMERY GRINDERS (PORTABLE)—
Norton Emery Wheel Co., Worcester, Mass.
Stow Mfg. Co. Binghamton, N. Y.
FACING—
Jos. Dixon Crucible Co., Jersey City, N. J.
The S. Obermayer Co., Cincinnati and Chicago.
J. W. Paxson Co., Philadelphia, Pa.
The J. D. Smith Fdy. Supply Co., Cleveland.
F. B. Stevens, Detroit, Mich.
FIRE BRICK AND CLAY—
Geo. G. Blackwell Sons & Co., Liverpool, England.
Clearfield Fire Brick Co., Clearfield, Pa.
Dover Fire Brick Co., Cleveland, O.
F. B. Holmes & Co., Detroit, Mich.
Kier Fire Brick Co., Pittsburg, Pa.
McFeely-Wheeler Brick Co., Pittsburg, Pa.
Mount Union Silica Brick Co., Pittsburg, Pa.
Niles Fire Brick Co., Niles, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
The S. Obermayer Co., Cincinnati and Chicago.
Ohio Fire Brick Co., Oak Hill, O.
J. W. Paxson Co., Philadelphia, Pa.
Pennsylvania Silica Brick & Mfg. Co., Pittsburg, Pa.
Portsmouth Harbison-Walker Co., Portsmouth, Ohio.
Savage Fire Brick Co., Pittsburg, Pa.
Scioto Fire Brick Co., Sciotoville, O.
The J. D. Smith Fdy. Supply Co., Cleveland.
Jos. Soisson Fire Brick Co., Connellsville, Pa.
F. B. Stevens, Detroit, Mich.
FLASKS—
J. W. Paxson Co., Philadelphia, Pa.
The S. Obermayer Co., Cincinnati and Chicago.
Northern Engineering Works, Detroit, Mich.
The S. Obermayer Co., Cincinnati and Chicago.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
The J. D. Smith Fdy. Supply Co., Cleveland.
FURNACES (CRUCIBLE)—
The S. Obermayer Co., Cincinnati and Chicago.
J. W. Paxson Co., Philadelphia, Pa.
GRAPHITE—
Jos. Dixon Crucible Co., Jersey City, N. J.
The S. Obermayer Co., Cincinnati and Chicago.
J. W. Paxson Co., Philadelphia, Pa.
The J. D. Smith Fdy. Supply Co., Cleveland.
HAMMERS (PNEUMATIC CHIPPING)—
Cleveland Pneumatic Tool Co., Cleveland, O.
Thos. H. Dallett Co., Philadelphia, Pa.
HOISTS (ELECTRIC)—
Case Manufacturing Co., Columbus, O.
Cleveland Crane & Car Co., Wickliffe, O.
C. W. Hunt Co., West New Brighton, N. Y.
Lidgerwood Mfg. Co., New York City.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger, Milwaukee, Wis.
HOISTS (PNEUMATIC)—
General Pneumatic Tool Co., Montour Falls, N. Y.
Niles Tool Works Co., New York City.
Northern Engineering Works, Detroit, Mich.
The S. Obermayer Co., Cincinnati and Chicago.
Rand Drill Co., New York City.
HOISTS (PORTABLE)—
Brown Hoisting Machy. Co., Cleveland, O.
Cleveland Crane & Car Co., Wickliffe, O.
General Pneumatic Tool Co., Montour Falls, N. Y.
J. W. Moyer & Co., Philadelphia, Pa.
Niles Tool Works Co., New York City.
Northern Engineering Works, Detroit, Mich.
LADLES—
Byram & Co., Detroit, Mich.
Girard Boiler & Mfg. Co., Girard, O.
The Meehan Boiler & Construction Co., Lowellville, O.
Northern Engineering Works, Detroit, Mich.
The S. Obermayer Co., Cincinnati and Chicago.
J. W. Paxson Co., Philadelphia, Pa.
Wm. B. Pollock Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
The J. D. Smith Fdy. Supply Co., Cleveland.
M. H. Treadwell & Co., New York City.
MAGNETIC SEPARATORS—
Dings Electro Magnetic Separator Co., Milwaukee, Wis.
MOLDING MACHINES—
The Adams Co., Dubuque, Ia.
Maywood Fdy. & Mach. Co., Chicago, Ill.
The S. Obermayer Co., Cincinnati and Chicago.
J. W. Paxson Co., Philadelphia, Pa.
Henry E. Pridmore, Chicago, Ill.
The J. D. Smith Fdy. Supply Co., Cleveland.
Tabor Mfg. Co., Philadelphia, Pa.
Taylor, Wilson & Co., Limited, Allegheny, Pa.
PATTERN FILLET—
The S. Obermayer Co., Cincinnati and Chicago.
J. W. Paxson Co., Philadelphia, Pa.
The J. D. Smith Fdy. Supply Co., Cleveland.
PATTERN LETTERS—
Cleveland Galvanizing Works, Cleveland, O.
The S. Obermayer Co., Cincinnati and Chicago.
The J. D. Smith Fdy. Supply Co., Cleveland.
PATTERNS—
Balkwill Pattern Works, Cleveland, O.
Buffalo Gear & Pattern Works, Buffalo, N. Y.
Diamond Drill & Mach. Co., Birdsboro, Pa.
Eden & Co., Bridgeport, Conn.
Forsyth Pattern Works, Youngstown, O.
The Globe Machine & Stamping Co., Cleveland.
Gobeille Pattern Co., Cleveland, O.
Hartford Pattern & Model Co., Hartford, Conn.
R. E. Kidder, Worcester, Mass.
Mahoning Foundry & Machine Co., Youngstown, O.
H. A. Olmstead Co., New York City.
The Turner, Vaughn & Taylor Co., Cuyahoga Falls, Ohio.
Wellman-Seaver-Morgan Engineering Co., Cleveland, O.
Wilks Pattern Co., Toledo, O.
PATTERN SHOP EQUIPMENT—
Badger State Machine Co., Janesville, Wis.
Fox Machine Co., Grand Rapids, Mich.
PIG IRON—
See Pig Iron, Division V.
PLUMBAGO—
The S. Obermayer Co., Cincinnati and Chicago.
J. W. Paxson Co., Philadelphia, Pa.
The J. D. Smith Fdy. Supply Co., Cleveland.
RAMMERS—
Brown & Sharpe Mfg. Co., Providence, R. I.
The S. Obermayer Co., Cincinnati and Chicago.
The J. W. Paxson Co., Philadelphia, Pa.
RAPPING PLATES—
J. W. Paxson Co., Philadelphia, Pa.
The J. D. Smith Fdy. Supply Co., Cleveland.

SAND BLAST APPARATUS—
J. W. Paxson Co., Philadelphia, Pa.
SAWING OFF MACHINES (STEEL FOUNDRY)—
See Cutting Off Machines, Division I.
SAND (MOLDING)—
The S. Obermayer Co., Cincinnati and Chicago.
Ohio Sand Co., Conneaut, O.
J. W. Paxson Co., Philadelphia, Pa.
The J. D. Smith Fdy. Supply Co., Cleveland.
F. B. Stevens, Detroit, Mich.
SAND SIFTERS—
Hanna Engineering Works, Chicago, Ill.
SPRUE CUTTING MACHINES—
Niles Tool Works Co., New York City.
Falkenau-Sinclair Mach. Co., Philadelphia, Pa.
Northern Engineering Works, Detroit, Mich.
The S. Obermayer Co., Cincinnati and Chicago.
The J. W. Paxson Co., Philadelphia, Pa.
F. B. Shuster & Co., New Haven, Conn.
The J. D. Smith Fdy. Supply Co., Cleveland.
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.

TRAMWAYS—
Atlas Car & Mfg. Co., Cleveland, O.
C. W. Hunt Co., West New Brighton, N. Y.
Arthur Koppel, New York City.
J. W. Moyer & Co., Philadelphia, Pa.
Northern Engineering Works, Detroit, Mich.
J. G. Speidel, Reading, Pa.
M. H. Treadwell & Co., New York City.

TUMBLERS—
The Adams Co., Dubuque, Ia.
Globe Machine & Stamping Co., Cleveland, O.
Northern Engineering Works, Detroit, Mich.
The S. Obermayer Co., Cincinnati and Chicago.
The J. W. Paxson Co., Philadelphia, Pa.
The J. D. Smith Fdy. Supply Co., Cleveland.

VIBRATORS (PNEUMATIC)—
Tabor Mfg. Co., Philadelphia, Pa.

WOOD TRIMMERS—
Fox Machine Co., Grand Rapids, Mich.

# DIVISION IV
# Power Plant Equipment

AIR COMPRESSORS—
See Air Compressors, Division II.
ANGLE POWER TRANSMITTER—
Patterson, Gottfried & Hunter, Ltd., N. Y. City.
BELT DRESSING—
The Ironsides Co., Columbus, O.
BELTING—
Buhl Malleable Co., Detroit, Mich.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Gandy Belting Co., Baltimore, Md.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
BOILERS—
The Allis-Chalmers Co., Chicago, Ill.
Atlas Engine Works, Indianapolis, Ind.
The Aultman Co., Canton, O.
Clearfield Steel and Iron Co., Pittsburg, Pa.
Dravo, Doyle & Co., Pittsburg, Pa.
Enterprise Boiler Co., Youngstown, O.
Forest City Boiler Co., Cleveland, O.
The Girard Boiler & Mfg. Co., Girard, O.
Harrison Safety Boiler Works, Philadelphia.
Hooven, Owens & Rentschler Co., Hamilton, O.
Meehan Boiler & Construction Co., Lowellville, O.
Niles Boiler Co., Niles, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Struthers-Wells Co., Warren, Pa.
Tudor Boiler Mfg. Co., Cincinnati, O.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
Vilter Mfg. Co., Milwaukee, Wis.
BOILER FEEDERS—
A. S. Cameron Steam Pump Co., New York.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
BOILER TUBES—
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
S. Fix's Sons, Cleveland, O.
National Tube Co., Pittsburg, Pa.
Joseph T. Ryerson & Son, Chicago, New York and Pittsburg.
Scully Steel & Iron Co., Chicago, Ill.
BURNERS—
See Fuel Oil Burners, Division VI.
COAL & ASH HANDLING MACHINERY—
The Atlas Car & Mfg. Co., Cleveland, O.
The Aultman Co., Canton, O.
C. O. Bartlett & Snow Co., Cleveland, O.
Buhl Malleable Co., Detroit, Mich.
C. W. Hunt Co., West New Brighton, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Kaltenbach & Griess, Cleveland, O.
Arthur Koppel, New York City.
Link-Belt Machinery Co., Chicago, Ill.
J. W. Moyer & Co., Philadelphia, Pa.
Russel Wheel & Fdy. Co., Detroit, Mich.
M. H. Treadwell & Co., New York City.
CONDENSERS—
A. S. Cameron Steam Pump Wks., New York.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Vilter Mfg. Co., Milwaukee, Wis.
COUPLINGS (COMPRESSION)—
The Aultman Co., Canton, O.
Buhl Malleable Co., Detroit, Mich.
H. W. Caldwell & Son Co., Chicago, Ill.
Case Manufacturing Co., Columbus, O.
Patterson, Gottfried & Hunter, Ltd., New York City.
Pratt & Whitney Co., Hartford, Conn.
DYNAMOS AND MOTORS—
See Electrical Machinery, Division II.
ECONOMIZERS (FUEL)—
Green Fuel Economizer Co., Matteawan, N. Y.
ENGINES—(AUTOMATIC HIGH SPEED)—
New Britain Machine Co., New Britain, Conn.
ENGINES (BLOWING)—
The Allis-Chalmers Co., Chicago, Ill.
Buckeye Engine Co., Salem, O.
Fischer Fdy. & Machine Co., Pittsburg, Pa.
Macbeth Iron Co., Cleveland, O.
Mesta Machine Co., Pittsburg, Pa.
Southwark Fdy. & Mach. Co., Philadelphia.
The Wm. Tod Co., Youngstown, O.
Weimer Mach. Wks., Lebanon, Pa.
ENGINES (CORLISS)—
The Allis-Chalmers Co., Chicago, Ill.
Atlas Engine Works, Indianapolis, Ind.
Brown Corliss Engine Co., Corliss, Wis.
Buckeye Engine Co., Salem, O.
C. & G. Cooper Co., Mt. Vernon, O.
Hooven, Owens & Rentschler Co., Hamilton, O.
Mesta Machine Co., Pittsburg, Pa.
Vilter Mfg. Co., Milwaukee, Wis.
Wickes, Bros., Pittsburg, Pa.
ENGINES (GAS)—
Miller Improved Gas Eng. Co., Springfield, O.
National Gear Wheel & Fdy. Co., Allegheny.
Northern Engineering Works, Detroit, Mich.
Struthers-Wells Co., Warren, Pa.
ENGINES (HOISTING)—
The Allis-Chalmers Co., Chicago, Ill.
Lidgerwood Mfg. Co., New York City.
Quincy Engine Works, Quincy, Ill.
ENGINES (STEAM)—
The Allis-Chalmers Co., Chicago, Ill.
Atlas Engine Works, Indianapolis, Ind.
The Aultman Co., Canton, O.
Ball Engine Co., Erie, Pa.
James Bonar & Co., Incor., Pittsburg, Pa.
Brown Corliss Engine Co., Corliss, Wis.
Buckeye Engine Co., Salem, O.
C. & G. Cooper Co., Mt. Vernon, O.
Dravo, Doyle & Co., Pittsburg, Pa.
Fischer Fdy. & Machine Co., Pittsburg, Pa.
Great Lakes Engineering Wks., Detroit, Mich.
I. & E. Greenwald Co., Cincinnati, O.
The Hooven, Owens & Rentschler Co., Hamilton, O.
Mesta Machine Co., Pittsburg, Pa.
Quincy Engine Works, Quincy, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Struthers-Wells Co., Warren, Pa.
The Wm. Tod Co., Youngstown, O.
Vilter Mfg. Co., Milwaukee, Wis.
ENGINES (REVERSING)—
Wm. Tod Co., Youngstown, O.
FEED WATER HEATERS AND PURIFIERS—
James Bonar & Co., Pittsburg, Pa.
Harrison Safety Boiler Works, Philadelphia.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Stewart Heater Co., Buffalo, N. Y.
A. T. Throop & Co., Buffalo, N. Y.
FILTERS (OIL)—
James Bonar & Co., Pittsburg, Pa.
S. F. Bowser & Co., Ft. Wayne, Ind.
Patterson, Gottfried & Hunter, Ltd., New York City.
J. R. Vandyck Co., New York City.
GAUGE COCKS—
Dravo, Doyle & Co., Pittsburg, Pa.
Forest City Boiler Co., Cleveland, O.
Green Fuel Economizer Co., Matteawan, N. Y.
I. & E. Greenwald Co., Cincinnati, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.
James Bonar & Co., Pittsburg, Pa.
Crane, Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
GRATE BARS—
A. T. Throop & Co., Buffalo, N. Y.
M. H. Treadwell & Co., New York City.
GREASE CUPS —
Lunkenheimer Co., Cincinnati, O.
Winkley Co., Hartford, Conn.
HANGERS—
The Aultman Co., Canton, O.
Baker Bros., Toledo, O.
H. W. Caldwell & Son Co., Chicago.
Case Manufacturing Co., Columbus, O.
Dodge Mfg. Co., Mishawaka, Ind.
I. & E. Greenwald, Cincinnati, O.
W. A. Jones Fdy. & Machine Co., Chicago, Ill.
Keasey Pulley Co., Toledo, O.
Link-Belt Machinery Co., Chicago, Ill.
INJECTORS—
Crane Co., Chicago, Ill.
Eynon-Evans Mfg. Co., Philadelphia, Pa.
Jenkins Bros., New York City.
The Lunkenheimer Co., Cincinnati, O.
LUBRICANTS—
The Ironsides Co., Columbus, O.
Jos. Dixon Crucible Co., Jersey City, N. J.
LUBRICATORS—
Jas. Bonar & Co., Pittsburg, Pa.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
METAL (ANTI-FRICTION)—
See Anti-Friction Metal, Division VI.
OIL CABINETS—
S. F. Bowser & Co., Ft. Wayne, Ind.
PACKING—
Jas. Bonar & Co., Pittsburg, Pa.
Crane Co., Chicago, Ill.
A. G. Hathaway & Co., Cleveland, O.
Jenkins Bros., New York City.
PIPE FITTERS—
Central Pipe, Valve & Cons. Co., Pittsburg, Pa.
POWER TRANSMISSION MACHINERY—
The Aultman Co., Canton, O.
Bertsch & Co., Cambridge City, Ind.
Buhl Malleable Co., Detroit, Mich.
H. W. Caldwell & Son Co., Chicago.
Case Manufacturing Co., Columbus, O.
Dodge Mfg. Co., Mishawaka, Ind.
Falkenau-Sinclair Mach. Co., Philadelphia, Pa.
I. & E. Greenwald Co., Cincinnati, O.
Jeffrey Mfg. Co., Columbus, O.
W. A. Jones Fdy. & Machine Co., Chicago, Ill.
Link-Belt Machinery Co., Chicago, Ill.
Niles Tool Works Co., New York City.
Patterson, Gottfried & Hunter, Ltd., New York City.
Quincy Engine Works, Quincy, Ill.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
PULLEYS—
The Aultman Co., Canton, O.
H. W. Caldwell & Son Co., Chicago.
Case Manufacturing Co., Columbus, O.
Dodge Mfg. Co., Mishawaka, Ind.
I. & E. Greenwald Co., Cincinnati, O.
Jeffrey Mfg. Co., Columbus, O.
W. A. Jones Fdy. & Machine Co., Chicago, Ill.
Link-Belt Machinery Co., Chicago, Ill.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
PULLEYS (STEEL FACED)—
Federal Mfg. Co., Cleveland, O.
PUMPS (HYDRAULIC)—
Waterbury-Farrel Fdy. & Mach. Co., Waterbury, Conn.
PUMPS (STEAM)—
The Allis-Chalmers Co., Chicago, Ill.
James Bonar & Co., Incor., Pittsburg, Pa.
A. S. Cameron Steam Pump Works, New City.
Dravo, Doyle & Co., Pittsburg, Pa.
Great Lakes Engineering Works, Detroit.
Laidlaw-Dunn-Gordon Co., New York City.
F. M. Prescott Steam Pump Co., Milwaukee.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Union Steam Pump Co., Battle Creek, Mich.
Watson-Stillman Co., New York City.
R. D. Wood & Co., Philadelphia, Pa.
SEPARATORS AND EXTRACTORS (STEAM OR OIL)—
James Bonar & Co., Pittsburg, Pa.
J. Wendell Cole, Columbus, O.
Dravo, Doyle & Co., Pittsburg, Pa.
Green Fuel Economizer Co., Matteawan, N. Y.
Harrison Safety Boiler Works, Philadelphia.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
A. T. Throop & Co., Buffalo, N. Y.
Stewart Heater Co., Buffalo, N. Y.
J. R. Vandyck Co., New York City.
SHAFTING—
American Steel & Wire Co., Chicago, Ill.
The Aultman Co., Canton, O.
Baker Bros., Toledo, O.
Bassett-Presley Co., Cleveland, O.
The Bourne-Fuller Co., Cleveland, O.
H. W. Caldwell & Son Co., Chicago.
Case Manufacturing Co., Columbus, O.
Cumberland Steel Co., Cumberland, Md.
Dodge Mfg. Co., Mishawaka, Ind.
Joseph Dyson & Sons, Cleveland, O.
I. & E. Greenwald Co., Cincinnati, O.
Arthur C. Harvey Co., Boston, Mass.
Jeffrey Mfg. Co., Columbus, O.
W. A. Jones Fdy & Machine Co., Chicago, Ill.
Link-Belt Machinery Co., Chicago, Ill.
Joseph T. Ryerson & Son, Chicago, New York and Pittsburg.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
STEAM SPECIALTIES—
Jas. Bonar & Co., Pittsburg, Pa.
A. S. Cameron Steam Pump Works, New York City.
Crane Co., Chicago, Ill.
Eynon-Evans Mfg. Co., Philadelphia, Pa.
Harrison Safety Boiler Works, Philadelphia.
Lunkenheimer Co., Cincinnati, O.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
J. R. Vandyck Co., New York City.
Winkley Co., Hartford, Conn.
TRAPS (STEAM)—
James Bonar & Co., Pittsburg, Pa.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
J. R. Vandyck, New York City.
TRANSMISSION ROPE (MANILA)—
Case Manufacturing Co., Columbus, O.
Dodge Mfg. Co., Mishawaka, Ind.
Link-Belt Machinery Co., Chicago, Ill.
VALVES—
Crane Co., Chicago, Ill.
The Lunkenheimer Co., Cincinnati, O.
Jenkins Bros., New York City.
Pittsburg Valve, Foundry & Construction Co Pittsburg, Pa.
R. D. Wood & Co., Philadelphia, Pa.
WATER COLUMNS AND ALARMS—
James Bonar & Co., Pittsburg, Pa.
Crane Co., Chicago, Ill.
The Lunkenheimer Co., Cincinnati, O.
J. R. Vandyck Co., New York City.
WATER SOFTENING PLANTS—
Harrison Safety Boiler Works, Philadelphia.
Pittsburg Filter Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

# DIVISION V
# Iron and Steel

AGRICULTURAL SHAPES—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Bassett-Presley Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
Joseph T. Ryerson & Son, Chicago, New York and Pittsburg.
Scully Steel & Iron Co., Chicago, Ill.

AIR BRAKE PINS—
Cleveland City Forge & Iron Co., Cleveland.
A. G. Hathaway & Co., Cleveland, O.

ANGLES—
See Structural Steel, Division V.

BARS (Iron and Steel)—
American Steel Hoop Co., Pittsburg, Pa.
Bassett-Presley Co., Cleveland, O.
Beals & Co., Buffalo, N. Y.
Bourne-Fuller Co., Cleveland, O.
Denman & Davis, New York City.
Forest City Steel & Iron Co., Cleveland, O.
Globe Rolling Mill Co., Cincinnati, O.
Harrow Spring Co., Kalamazoo, Mich.
Arthur C. Harvey Co., Boston, Mass.
F. R. Phillips & Son Co., Philadelphia, Pa.
Republic Iron & Steel Co., Chicago, Ill.
Joseph T. Ryerson & Son, Chicago, New York and Pittsburg.
Scully Steel & Iron Co., Chicago, Ill.
W. H. Thompson & Co., Philadelphia, Pa.

BEAMS—
See Structural Steel, Division V.

BOLTS AND NUTS—
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bassett-Presley Co., Cleveland, O.
A. G. Hathaway & Co., Cleveland, O.
Milton Manufacturing Co., Milton, Pa.
National Elastic Nut Co., Milwaukee, Wis.
Joseph T. Ryerson & Son, Chicago, New York and Pittsburg.
Scully Steel & Iron Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.

CASTINGS (Aluminum, Brass and Bronze)—
Lorain Foundry Co., Lorain, O.
Lunkenheimer Co., Cincinnati, O.
Ohio Brass Co., Mansfield, O.
The Turner, Vaughn & Taylor Co., Cuyahoga Falls, Ohio.

CASTINGS (Gray Iron)—
The Aultman Co., Canton, O.
Buffalo Foundry Co., Buffalo, N. Y.
Buhl Malleable Co., Detroit, Mich.
Cureton Foundry Co., Mt. Vernon, O.
Diamond Drill & Mach. Co., Birdsboro, Pa.
Eden & Co., Bridgeport, Conn.
Farrel Fdy. & Mach. Co., Ansonia, Conn.
Francis & Nygren Fdy. Co., Chicago, Ill.
Great Lakes Engineering Wks., Detroit, Mich.
W. A. Jones Fdy. & Mach. Co., Chicago, Ill.
Mahoning Fdy. & Mach. Co., Youngstown, O.
Nortmann-Duffke Fdy. Co., Milwaukee, Wis.
Quincy Engine Works, Quincy, Ill.
Geo. H. Smith Steel Casting Co., Milwaukee, Wis.
Taylor Wilson & Co., Limited, Allegheny, Pa.
M. H. Treadwell & Co., New York City.
The Turner, Vaughn & Taylor Co., Cuyahoga Falls, Ohio.
Wilks Foundry Co., Toledo, O.

CASTINGS (Machinery)—
The Aultman Co., Canton, O.
Buffalo Foundry Co., Buffalo, N. Y.
Cureton Foundry Co., Mt. Vernon, O.
Diamond Drill & Mach. Co., Birdsboro, Pa.
Farrel Fdy. & Mach. Co., Ansonia, Conn.
Great Lakes Engineering Wks., Detroit, Mich.
W. A. Jones Fdy. & Mach. Co., Chicago, Ill.
Mahoning Fdy. & Mach. Co., Youngstown, O.
Mesta Machine Co., Pittsburg, Pa.
Nortmann-Duffke Fdy. Co., Milwaukee, Wis.
Quincy Engine Works, Quincy, Ill.
Russel Wheel & Fdy. Co., Detroit, Mich.
Superior Iron Works, Superior, Wis.
Wm. Tod & Co., Youngstown, O.
M. H Treadwell & Co., New York City.
The Turner, Vaughn & Taylor Co., Cuyahoga Falls, Ohio.
United Engineering & Fdy. Co., Pittsburg, Pa.
Wilks Foundry Co., Toledo, O.

CASTINGS (Malleable)—
Acme Steel & Malleable Iron Works, Buffalo.
Buhl Malleable Co., Detroit, Mich.
Chicago Malleable Castings Co., West Pullman, Ill.
Meadville Malleable Iron Co., Meadville, Pa.

CASTINGS (Semi-Steel)—
Farrel Fdy. & Mach. Co., Ansonia, Conn.
Francis & Nygren Fdy. Co., Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Quincy Engine Works, Quincy, Ill.

CASTINGS (Steel)—
Acme Steel & Malleable Iron Works, Buffalo.
Diamond Drill & Mach. Co., Birdsboro, Pa.
Denman & Davis, New York City.
Mesta Machine Co., Pittsburg, Pa.
Nortmann-Duffke Fdy. Co., Milwaukee, Wis.
Otis Steel Co., Cleveland, O.
Geo. H. Smith Steel Casting Co., Milwaukee, Wis.

CHAINS—
Bassett-Presley Co., Cleveland, O.
Federal Mfg. Co., Cleveland, O.
Monongahela Iron & Steel Co., Pittsburg, Pa.

CHAINS (Machinery)—
Buhl Malleable Co., Detroit, Mich.
Federal Mfg. Co., Cleveland, O.

CHANNELS—
See Structural Steel, Division V.

CHROME ORE—
Geo. G. Blackwell, Sons & Co., Ltd., Liverpool, England.
Reed F. Blair & Co., Pittsburg, Pa.

CLEVIS NUTS—
Cleveland City Forge & Iron Co., Cleveland.

CORRUGATED IRON—
American Sheet Steel Co., New York City.
Bassett-Presley Co., Cleveland, O.
Berger Mfg. Co., Canton, O.
The Bourne-Fuller Co., Cleveland, O.
Empire Iron & Steel Co., Niles, O.
Garry Iron & Steel Co., Cleveland, O.
Joseph T. Ryerson & Son, Chicago, New York and Pittsburg.
Wm. B. Scaife & Son Co., Pittsburg, Pa.
Scully Steel & Iron Co., Chicago, Ill.
W. H. Thompson & Co., Philadelphia, Pa.

FERRO-MANGANESE—
Reed F. Blair & Co., Pittsburg, Pa.
Midvale Mining & Mfg. Co., St. Louis, Mo.

FERRO-SILICON—
Reed F. Blair & Co., Pittsburg, Pa.
Midvale Mining & Mfg. Co., St. Louis, Mo.

FORGINGS (Die)—
Columbus Forge & Iron Co., Columbus, O.
Joseph Dyson & Son, Cleveland, O.
Globe Machine & Stamping Co., Cleveland, O.
A. G. Hathaway & Co., Cleveland, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.
Sebring Forging Co., Sebring, O.
Transue & Williams Co., Alliance, O.
Wyman & Gordon, Worcester, Mass.

FORGINGS (Drop)—
Billings & Spencer Co., Hartford, Conn.
Chicago Drop Forge & Fdy. Co., Kensington, Ill.
Columbus Forge & Iron Co., Columbus, O.
E. D. Clapp Mfg. Co., Auburn, N. Y.
Cleveland City Forge & Iron Co., Cleveland.
Joseph Dyson & Sons, Cleveland, O.
Globe Machine & Stamping Co., Cleveland, O.
Great Lakes Engineering Wks., Detroit, Mich.
A. G. Hathaway & Co., Cleveland, O.
Pittsburg Shear, Knife & Machine Co., Pittsburg, Pa.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
Sebring Forging Co., Sebring, O.
Geo. B. Sennett Co., Youngstown, O.
Tindel-Morris Co., Eddystone, Pa.
Transue & Williams, Alliance, O.
Union Drop Forge Co., Chicago, Ill.
Wyman & Gordon, Worcester, Mass.

FORGINGS (Hydraulic Press)—
Cleveland City Forge & Iron Co., Cleveland.
Columbus Forge & Iron Co., Columbus, O.
Pressed Steel Tank Co., Milwaukee, Wis.
Sebring Forging Co., Sebring, O.
Wyman & Gordon, Worcester, Mass.

FORGINGS (Roll)—
Columbus Forge & Iron Co., Columbus, O.
Pittsburg Shear, Knife & Machine Co., Pittsburg, Pa.
Sebring Forging Co., Sebring, O.
Tindel-Morris Co., Eddystone, Pa.

GALVANIZED IRON AND STEEL—
American Sheet Steel Co., New York City.
Bassett-Presley Co., Cleveland, O.
The Berger Mfg. Co., Canton, O.
Bourne-Fuller Co., Cleveland, O.
Cleveland Galvanizing Works, Cleveland, O.
Joseph T. Ryerson & Son, Chicago, New York and Pittsburg.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
Scully Steel & Iron Co., Chicago, Ill.
W. H. Thompson & Co., Philadelphia, Pa.

HOOPS (Steel)—
See Steel Hoops, Division V.

INGOT MOLDS—
Reed F. Blair & Co., Pittsburg, Pa.
Lorain Foundry Co., Lorain, O.
The Wm. Tod Co., Youngstown, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.

IRON ORES—
Geo. G. Blackwell Sons & Co., Liverpool, Eng.
Reed F. Blair & Co., Pittsburg, Pa.
Corrigan, McKinney & Co., Cleveland, O.
Drake, Bartow & Co., Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
Ernest Law & Co., Philadelphia, Pa.
Oglebay, Norton & Co., Cleveland, O.
Pickands, Brown & Co., Chicago, Ill.
Pickands, Mather & Co., Cleveland, O.
The Tod-Stambaugh Co., Cleveland, O.

LAG SCREWS—
Bassett-Presley Co., Cleveland, O.
A. G. Hathaway & Co., Cleveland, O.

METALS (Antimony, Copper, Tin, etc.)—
Bassett-Presley Co., Cleveland, O.
Orford Copper Co., New York City.
Phosphor-Bronze Smelting Co., Philadelphia, Pa.
Joseph T. Ryerson & Son, Chicago, New York and Pittsburg.
Scully Steel & Iron Co., Chicago, Ill.

NICKEL—
Orford Copper Co., New York City.

NUTS AND BOLTS—
See Bolts and Nuts, Division V.

NUTS (Self-Locking)—
National Elastic Nut Co., Milwaukee, Wis.

PIG IRON—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Reed F. Blair & Co., Pittsburg, Pa.
Bourne-Fuller Co., Cleveland, O.
Clinton Iron & Steel Co., Pittsburg, Pa.
Columbus Iron & Steel Co., Columbus, O.
Corrigan, McKinney & Co., Cleveland, O.
J. K. Dimmick & Co., Philadelphia, Pa.
The Field-Evans Iron Co., Cincinnati, O.
M. A. Hanna & Co., Cleveland, O.
Hickman, Williams & Co., Chicago, Ill.
Howard M. Hooker & Co., Pittsburg, Pa.
Ernest Law & Co., Philadelphia, Pa.
McKeefrey & Co., Leetonia, O.
F. R. Phillips & Son Co., Philadelphia, Pa.
Pickands, Brown & Co., Chicago, Ill.
Pickands, Mather & Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
Rogers, Brown & Co., Cincinnati, O.
Shenango Furnace Co., Pittsburg, Pa.
Chas. G. Shepard, Buffalo, N. Y.
Sloss-Sheffield Steel & Iron Co., Birmingham, Ala.
F. B. Stevens, Detroit, Mich.
Superior Charcoal Iron Co., Grand Rapids, Mich.
Thomas Furnace Co., Milwaukee, Wis.
L. & R. Wister & Co., Philadelphia, Pa.

PIPE (Riveted Steel)—
Girard Boiler & Mfg. Co., Girard, O.
The Meehan Boiler & Construction Co., Lowellville, O.
Wm. B. Pollock Co., Youngstown, O.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.

PIPE (Wrought)—
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
Crane Co., Chicago, Ill.
National Tube Co., Pittsburg, Pa.
Pittsburg Valve, Foundry & Construction Co., Pittsburg, Pa.

PLATES—
American Steel & Wire Co., Chicago, Ill.
Bassett, Presley Co., Cleveland, O.
Beals & Co., Buffalo, N. Y.
Bourne-Fuller Co., Cleveland, O.
Denman & Davis, New York City.
Enterprise Boiler Co., Youngstown, O.
Girard Boiler & Mfg. Co., Girard, O.
Globe Rolling Mill Co., Cincinnati, O.
Arthur C. Harvey Co., Boston, Mass.
Republic Iron & Steel Co., Chicago, Ill.
Russel Wheel & Fdy. Co., Detroit, Mich.
Joseph T. Ryerson & Son, Chicago, New York and Pittsburg.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
Scully Steel & Iron Co., Chicago, Ill.

RAILS—
American Steel Hoop Co., Pittsburg, Pa.
The Atlas Car & Mfg. Co., Cleveland, O.
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
Hyde Bros. & Co., Pittsburg, Pa.
Arthur Koppel, New York City.
Ernest Law & Co., Philadelphia, Pa.
Lorain Steel Co., Lorain, O.
F. R. Phillips & Son Co., Philadelphia, Pa.

RIVETS.

American Iron and Steel Mfg. Co., Lebanon, O.
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
Forest City Steel & Iron Co., Cleveland, O.
Arthur C. Harvey Co., Boston, Mass.
A. G. Hathaway & Co., Cleveland, O.
Joseph T. Ryerson & Son, Chicago, New York and Pittsburg.
Scully Steel & Iron Co., Chicago, Ill.

RODS (WIRE)—

American Steel & Wire Co., Chicago, Ill.
Republic Iron & Steel Co., Chicago, Ill.

SCRAP IRON—

A. G. Hathaway & Co., Cleveland, O.
Hyde Bros. & Co., Pittsburg, Pa.
F. R. Phillips & Son Co., Philadelphia, Pa.

SHAFTING (GROUND STEEL)—

Cumberland Steel Co., Cumberland, Md.

SHAFTING (STEEL)—

Cumberland Steel Co., Cumberland, Md.

SHEET METAL STAMPINGS—

Avery Stamping Co., Cleveland, O.
Federal Mfg. Co., Cleveland, O.
The Globe Machine & Stamping Co., Cleveland, O.
Pressed Steel Tank Co., Milwaukee, Wis.

SHEETS (IRON AND STEEL)—

American Sheet Steel Steel Co., New York City.
American Steel & Wire Co., Chicago, Ill.
Bassett-Presley Co., Cleveland, O.
Beals & Co., Buffalo, N. Y.
The Berger Mfg. Co., Canton, O.
Bourne-Fuller Co., Cleveland, O.
Denman & Davis, New York City.
Empire Iron & Steel Co., Niles, O.
Globe Rolling Mill Co., Cincinnati, O.
Goff, Horner & Co., Pittsburg, Pa.
Arthur C. Harvey Co., Boston, Mass.
Republic Iron & Steel Co., Chicago, Ill.
Joseph T. Ryerson & Son, Chicago, New York and Pittsburg.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
Scully Steel & Iron Co., Chicago, Ill.
W. H. Thomson & Co., Philadelphia, Pa.
West Leechburg Steel & Tin Plate Co., Pittsburg, Pa.
Zug & Co., Pittsburg, Pa.

SPIKES—

A. G. Hathaway & Co., Cleveland, O.

SPRINGS—(AGRICULTURAL).

Harrow Spring Co., Kalamazoo, Mich.

SPRINGS—(CAR).

Harrow Spring Co., Kalamazoo, Mich.

STEEL—

American Steel Hoop Co., Pittsburg, Pa.
Bassett-Presley Co., Cleveland, O.
American Steel & Wire Co., Chicago, Ill.
Bourne-Fuller Co., Cleveland, O.
Denman & Davis, New York City.
J. K. Dimmick & Co., Philadelphia, Pa.
Forest City Steeel & Iron Co., Cleveland, O.
Harrow Spring Co., Kalamazoo, Mich.
Arthur C. Harvey Co., Boston, Mass.
Wm. Jessop & Son, New York City.
Ernest Law & Co., Philadelphia, Pa.
Otis Steel Co., Cleveland, O.
Norwalk Steel & Iron Co., Norwalk, O.
Republic Iron & Steel Co., Chicago, Ill.
Joseph T. Ryerson & Son, Chicago, New York and Pittsburg.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
Scully Steel & Iron Co., Chicago, Ill.
W. H. Thomson & Co., Philadelphia, Pa.
L. & R. Wister & Co., Philadelphia, Pa.

STEEL (COLD DRAWN)—

Cumberland Steel Co., Cumberland, Md.

STEEL (SPRING)—

Harrow Spring Co., Kalamazoo, Mich.

STEEL BANDS—

American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
Arthur C. Harvey Co., Boston, Mass.
West Leechburg Steel & Tin Plate Co., Pittsburg, Pa.

STEEL BLOOMS AND BILLETS—

American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
Ernest-Law & Co., Phildelphia, Pa.
The Lorain Steel Co., Lorain, O.
E. R. Phillips & Son Co., Philadelphia, Pa.

STEEL HOOPS—

American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
Arthur C. Harvey Co., Boston, Mass.
Joseph T. Ryerson & Son, Chicago, New York and Pittsburg.
Scully Steel & Iron Co., Chicago, Ill.
West Leechburg Steel & Tin Plate Co., Pittsburg, Pa.

STRUCTURAL STEEL—

American Steel Hoop Co., Pittsburg, Pa.
Bassett-Presley Co., Cleveland, O.
Reed F. Blair & Co., Pittsburg, Pa.
G. L. Bollinger Co., Pittsburg, Pa.
Bourne-Fuller Co., Cleveland, O.
Forest City Steel & Iron Co., Cleveland, O.
Globe Rolling Mill Co., Cincinnati, O.
Arthur C. Harvey Co., Boston, Mass.
McClintic-Marshall Cons. Co., Pittsburg, Pa.
F. R. Phillips & Son Co., Philadelphia, Pa.
Republic Iron & Steel Co., Chicago, Ill.
Russel Wheel & Foundry Co., Chicago, Ill.
Joseph T. Ryerson & Son, Chicago, New York and Pittsburg.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
Scully Steel & Iron Co., Chicago, Ill.

TIN AND TERNE PLATES—

American Tin Plate Co., Pittsburg, Pa.
Bassett-Presley Co., Cleveland, O.

TOOL STEEL—

American Steel & Wire Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago.
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
Colonial Steel Co., Pittsburg, Pa.
Denman & Davis, New York City.
J. K. Dimmick & Co., Philadelphia, Pa.
Arthur C. Harvey Co., Boston, Mass.
Wm. Jessop & Son, New York City.
Edwin R. Kent & Co., Chicago, Ill.
Norwalk Steel & Iron Co., Norwalk, O.
Joseph T. Ryerson & Son, Chicago, New York and Pittsburg.
Scully Steel & Iron Co., Chicago, Ill.

TUBES (IRON & STEEL)—

Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
S. Fix's Sons, Cleveland, O.
Globe Rolling Mill Co., Cincinnati, O.
National Tube Co., Pittsburg, Pa.
Joseph T. Ryerson & Son, Chicago, New York and Pittsburg.
Scully Steel & Iron Co., Chicago, Ill.

TUBES (SEAMLESS)—

Shelby Steel Tube Co., Pittsburg, Pa.

TURNBUCKLES—

American Steel & Wire Co., Chicago, Ill.
Bassett-Presley Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
Cleveland City Forge & Iron Co., Clevelarfd, O.
A. G. Hathaway & Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
Joseph T. Ryerson & Son, Chicago, New York and Pittsburg.

WASHERS—

American Iron & Steel Mfg. Co., Lebanon, Pa.
Avery Stamping Co., Cleveland, O.
Bassett-Presley Co., Cleveland, O.
A. G. Hathaway & Co., Cleveland, O.
Milton Mfg. Co., Milton, Pa.
Scully Steel & Iron Co., Chicago, Ill.
Joseph T. Ryerson & Son, Chicago, New York and Pittsburg.
Upson Nut Co., Cleveland, O.

WIRE—

American Steel & Wire Co., Chicago, Ill.
National Steel & Wire Co., New York and San Francisco.

WIRE (BARBED AND FENCE)—

American Steel & Wire Co., Chicago, Ill.
Bassett-Presley Co., Cleveland, O.
National Steel & Wire Co., New Haven, Conn.

WIRE (CABLE AND ROPE)—

American Steel & Wire Co., Chicago, Ill.
Bassett-Presley Co., Cleveland, O.
Lidgerwood Mfg. Co., New York City.
National Steel & Wire Co., New Haven, Conn.
Scully Steel & Iron Co., Chicago, Ill.

WIRE (NAILS)—

American Steel & Wire Co., Chicago, Ill.
National Steel & Wire Co., New Haven, Conn.

## DIVISION VI

# Miscellaneous Equipment and Supplies

ANTI-FRICTION METAL—

Cool Running Graphite Metal Co., Cincinnati.
Phosphor-Bronze Smelting Co., Philadelphia, Pa.

AUTOMOBILE PARTS—

Federal Mfg. Co., Cleveland, O.

BALLS (STEEL)—

The American Ball Co., Providence, R. I.
Federal Mfg. Co., Cleveland, O.

BABBITT METAL—

Bassett-Presley Co., Cleveland, O.
Lorain Foundry Co., Lorain, O.
F. R. Phillips & Son Co., Philadelphia, Pa.

BARROWS (WHEEL)—

See Barrows, Division, Ill.

BELT DRESSING—

See Belt Dressing Division IV.

BELTING—

See Belt Dressing, Division IV.

BLAST FURNACE WORK—

Catawissa Car & Fdy. Co., Catawissa, Pa.
Enterprise Boiler Co., Youngstown, O.
The Girard Boiler & Mfg. Co., Girard, O.
The Kloman Co., Pittsburg, Pa.
Mahoning Fdy. & Mach. Co., Youngstown, O.
Meehan Boiler & Construc. Co., Lowellville, O.
Henry S. Mould, Co., Pittsburg, Pa.
Pittsburg Valve, Foundry & Construction Co., Pittsburg, Pa.
The Wm. B. Pollock Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Russel Wheel & Fdy. Co., Detroit, Mich.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.
Southwark Fdy. & Mach. Co., Philadelphia, Pa.

M. H. Treadwell & Co., New York City.
Weimer Machine Works Co., Lebanon, Pa.
Wellman-Seaver-Morgan Engineering Co., Cleveland, O.

BRIDGES—
G. L. Bollinger Co., Pittsburg, Pa.
John Eichleay, Jr., Co., Pittsburg, Pa.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.

BUILDINGS (STEEL AND IRON)—
G. L. Bollinger Co., Pittsburg, Pa.
John Eichleay, Jr., Co., Pittsburg, Pa.
Forest City Steel & Iron Co., Cleveland, O.
Garry Iron & Steel Co., Cleveland, O.
Kaltenbach & Griess, Cleveland, O.
McClintic-Marshall Cons. Co., Pittsburg, Pa.
Pittsburg Construction Co., Pittsburg, Pa.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Russel Wheel & Fdy. Co., Detroit, Mich.
Wm. B. Scaife & Sons Co., Pittsburg, Pa.

CARBORUNDUM—
The Carborundum Co., Niagara Falls, N. Y.

CARS (BALLAST)—
C. W. Hunt Co., West New Brighton, N. Y.
M. H. Treadwell & Co., New York City.

CARS (CINDER AND HOT METAL)—
Atlas Car & Mfg. Co., Cleveland, O.
C. W. Hunt Co., West New Brighton, N. Y.
Arthur Koppel, New York City.
Wm. B. Pollock Co., Youngstown, O.
W. H. Treadwell & Co., New York City.
Weimer Machine Works Co., Lebanon, Pa.

CARS (INDUSTRIAL AND MINE)—
Atlas Car & Mfg. Co., Cleveland, O.
C. W. Hunt Co., West New Brighton, N. Y.
Arthur Koppel, New York City.
Edgar S. Low Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Wm. B. Pollock Co., Youngstown, O.
Russel Wheel & Fdy. Co., Detroit, Mich.
M. H. Treadwell & Co., New York City.

CASTING MACHINES—
Weimer Machine Works Co., Lebanon, Pa.

CEILINGS—
Berger Mfg. Co., Canton, O.

CEMENT—
Reed F. Blair & Co., Pittsburg, Pa.

CHAIN BELTING—
The Aultman Co., Canton, O.
Buhl Malleable Co., Detroit, Mich.
H. W. Caldwell & Son Co., Chicago, Ill.
Case Mfg. Co., Columbus, O.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machiney Co., Chicago, Ill.

CHARGING BARROWS—
Wm. B. Pollock Co., Youngstown, O.
Weimer Machine Works Co., Lebanon, Pa.

CHEMISTS—
F. A. Emmerton, Cleveland, O.
Grasselli Chemical Co., Cleveland, O.
The R. W. Hunt & Co., Chicago, Ill.
The Metallurgical Laboratory, Pittsburg, Pa.
O. Textor, Cleveland, O.

COAL AND COKE—
Bessemer Coke Co., Pittsburg, Pa.
Reed F. Blair & Co., Pittsburg, Pa.
The Bourne-Fuller Co., Cleveland,
W. H. Coffman Coke Co., Bluefield, W. Va.
J. K. Dimmick & Co., Philadelphia, Pa.
M. A. Hanna & Co., Cleveland, O.
Howard M. Hooker & Co., Pittsburg, Pa.
Ernest Law & Co., Philadelphia, Pa.
Manhattan Coal & Coke Co., Philadelphia, Pa.
McKeefrey & Co., Leetonia, O.
Pickands, Brown & Co., Chicago, Ill.
Pickands, Mather & Co., Cleveland, O.
Rogers, Brown & Co., Cincinnati, O.
Chas. G. Shepard, Buffalo, N. Y.
Sloss-Sheffield Steel & Iron Co., Birmingham, Ala.
W. H. Thomson & Co., Philadelphia, Pa.
Washington Coal & Coke Co., Pittsburg, Pa.
L. & R. Wister & Co., Philadelphia, Pa.

COKE OVENS—
United Coke & Coke Co., New York City.

COMMUTATORS—
Van Dorn-Elliott Electric Co., Cleveland, O.

COMPAROMETERS—
The Fullman Co., Pittsburg, Pa.

CRAYONS—
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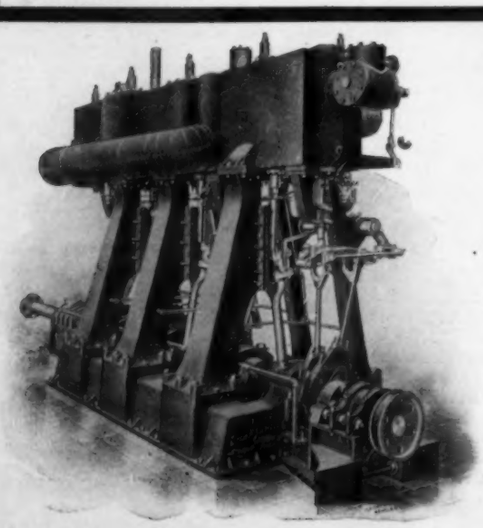

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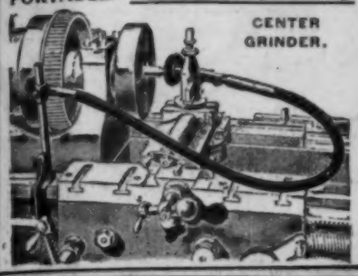

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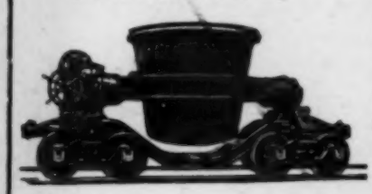

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401 People's Savings Bank Bldg., Pittsburg, Pa.
47 Victoria St., London, England.

For your convenience we have incorporated a Telegraphic Cipher Code in our Monthly Stock-list. A word for a size.
Can also be used for mill shipments.

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**BOURNE-FULLER CO.**
**IRON, STEEL,**
**PIG IRON,**
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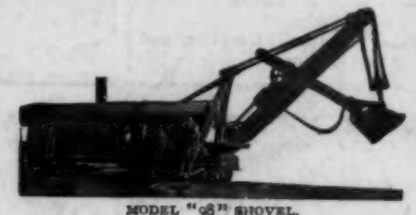
**Cleveland, Ohio.**

# STEAM SHOVELS

**FOR MINING**

Our Steam Shovels embody the latest improvements to be found in machinery of this class, and are especially constructed to meet the requirements of mining. Can furnish machines with the combination wood-and-steel or the all-steel construction as desired.



MODEL "98" SHOVEL.

We make our own steel and grey iron castings, also our own chain.

**The Marion Steam Shovel Co.**

**640 West Center St.,**
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